THE GEOGRAPHICAL JOURNAL

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LOUISIANA STORY. *Documentary film on the exploration of the Louisiana oilfields.*

Monday December 22 at 8.15 p.m.

EXPEDITION TO CHO-OYU. *By Eric Shipton.*

Friday January 2 at 3 p.m.

THE RELATIONS OF GEOGRAPHY AND HISTORY. *By Professor H. C. Darby. Joint Meeting with the Geographical Association and the Institute of British Geographers.*

Monday January 5 at 5.30 p.m.

AUDUBON'S AMERICA. *Kodachrome film by the Audubon Society of America, in commemoration of the 100th anniversary of the death of America's first great naturalist, with commentary by Miss Katharine Tousey.*

Monday January 12 at 8.15 p.m.

DANISH DEEP SEA EXPEDITION 1951–52. *By Dr. Anton Brun.*

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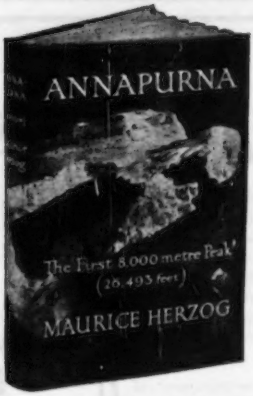

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JUGOSLAV MACEDONIA IN TRANSITION

H. R. WILKINSON

THE POLITICAL GEOGRAPHY of Eastern Europe has undergone many changes as a result of developments which took place during and after the Second World War. Amongst the most interesting of these changes was the emergence of Macedonia in 1945 as one of the republics of a newly federated Jugoslavia. It consists largely of that disputed frontier territory south of the Šar Mountains which came into the possession of Serbia as a result of the Balkan Wars of 1912–13, and which in 1939 was known as South Serbia and formed part of the Vardarska *banovina* (Fig. 1). The new republic is so manifestly different both in its extent and in the character of its population from the ancient Macedonia that one is prompted to wonder who the modern Macedonians are, and by what diverse processes a republic of that name has come to be part of Jugoslavia. The tangled sequence of events which led to the formation of a modern republic of Macedonia antedates the recent war and is difficult to unravel, but certain ideas which influenced the issue are simple enough to trace. They were four in number. The first was connected with the survival of Macedonia as a place-name; the second was the concept of Macedonia as a geographical region; the third was the Macedo-Slav theory and the fourth was the idea of a Macedonian nation.

I. THE GENESIS OF THE MACEDONIAN REPUBLIC

In Europe there are many place-names which have strong historical associations, but none more so than Macedonia. It is a measure of the fame of the ancient Macedonians that their name has survived for over two thousand years to describe a corner of the Balkan Peninsula, long after they themselves ceased to play any important part in European history. The place-name, Macedonia, was in all probability based on the personal name of a chieftain of one of the tribes living in the northern frontier regions of ancient Greece. With the advent of the Macedonians as a military power its use became less restricted, and it was applied loosely to all that territory coming under the immediate jurisdiction of the Macedonian rulers. Later, when the Romans conquered Greece, they made Macedonia into one of their provinces which stretched "northward of Thessaly and Mount Olympus, eastward of

the chain by which Pindus is continued and westward of the river Axius." [1] It was this idea of the extent of Macedonia which became popular in Western Europe during the eighteenth and early nineteenth centuries and it was, of course, in its Latin form that the name Macedonia first came into popular usage. It is in this form that it is familiar to us to-day.

Until the middle decades of the nineteenth century very little was known to the rest of Europe concerning the geography of that part of its territory then occupied by the Turks. It was commonly accepted, for example, that

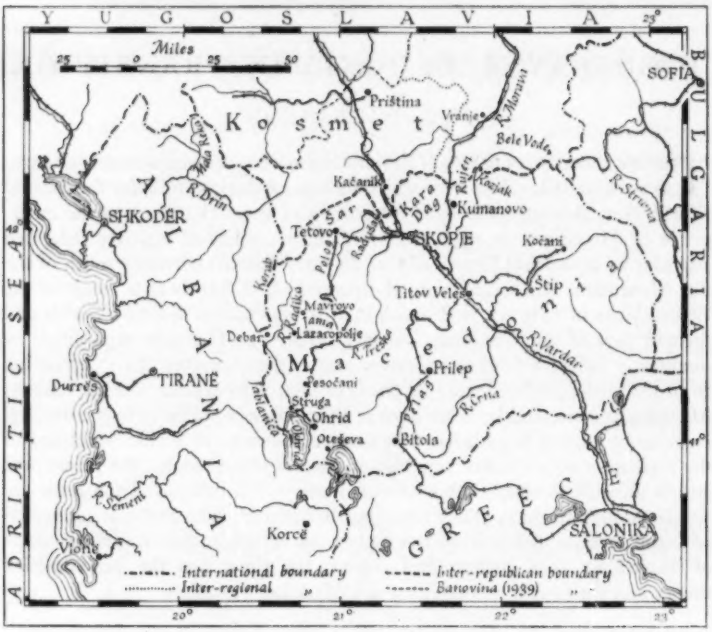


Fig. 1. The Republic of Macedonia [2]

the Balkan mountains functioned in much the same way as did the Alps and the Pyrenees, in forming a continuous range cutting off a peninsula from easy contact with the rest of Europe—hence the name Balkan Peninsula. In the absence of other information, references from classical sources were often employed to describe features of the geography of this area. This explains why classical place-names like Macedonia, Epirus and Moesia became quite popular geographical expressions. Such places were often described as if no changes had taken place since the Romans were in

[1] William Smith, 'Dictionary of Greek and Roman geography,' London, 1857.

[2] Based on 'Federativna Narodna Republika Jugoslavije', Geographical Institute of the Jugoslav Army, 1947.

occupation. Thus a British topographer wrote of Macedonia in 1709: "It is Rich in divers Mines of Gold, abounds with Corn, Pasture, Cattle, Venison, and in some Parts Wine and Oyl."[1] As late as 1822, such descriptions of Macedonia as, "Its figure is irregular, its situation advantageous, and the air clear, sharp and salubrious," were not uncommon.[2] Quaint as these descriptions were they did serve a purpose, because they gave rise to the assumption that Macedonia was a geographical entity of some kind. As the century advanced and more became known about the Balkan Peninsula the assumption remained, even though it became generally apparent that little or nothing of the ancient Macedonia had survived. Thus A. Boué in his classic account of Turkey-in-Europe found Macedonia a most useful geographical expression[3], as did many of his contemporaries.

The tendency in the literature of the period to make frequent references to Macedonia, Albania, Thrace, Epirus and so on had rather surprising consequences when it became fairly obvious to the rest of Europe that Turkish power in the Balkans was fast declining. The possibility of a Turkish demise invested these loosely applied place-names with a political significance which they might not otherwise have attained. Especially was this true of Macedonia, and an indication of this was given in 1870 when, at the Conference of Constantinople, the possibility of creating an autonomous "Macedonian province" was raised in discussions between British, Austrian and Russian representatives. Again, in 1878, as part of the Austrian proposals for the revision of the Treaty of San Stefano, Count Andrassy, the Austrian Foreign Minister, put forward a plan for the establishment of an "autonomous Macedonia with Salonika as part of the new province." It was to be divided from Bulgaria by a line drawn between the Gulf of Orfano (Strimon) and Vranje.[4] Through a process of association of ideas Macedonia had by 1878 become a possible unit in the future political fabric of the Balkan Peninsula. The tragedy was that its unity was abstract. It had no definite boundaries and no homogeneity of population. Attempts by interested scholars to remedy these deficiencies resulted in a curious conflict of opinion, and certain ideas were expressed which proved to be of great consequence for the future of the Balkan Peninsula.

Geographical Macedonia

Bulgarian geographers working for the ultimate incorporation of Macedonia into Bulgaria began to put forward detailed geographical definitions of Macedonia about 1890, and to justify their definitions on grounds of physical and human geography. Of these V. Kănčev's definition was probably the best known and most influential (Fig. 2). The Internal Macedonian Revolutionary Organization (IMRO), a notorious secret society, adopted this definition in its programme (Fig. 3). Later, J. Jaranov, a Macedonian geographer, elaborated Kănčev's concept in a number of works devoted

[1] 'The compleat geographer or the chorography and topography of the known parts of the earth,' London, 1709.

[2] J. W. Clarke, 'A new geographical dictionary,' vol. 2, London, 1822.

[3] Ami Boué, 'La Turquie d'Europe,' Paris, 1840.

[4] M. D. Stojanović, 'The Great Powers and the Balkans, 1875–78,' Cambridge, 1939.

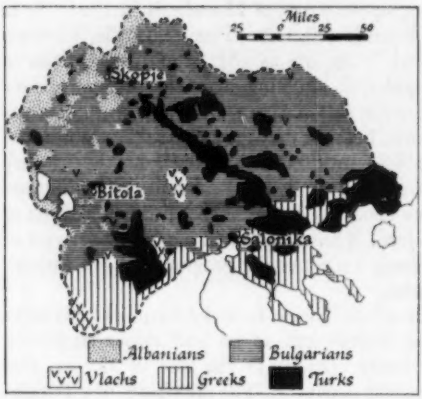


Fig. 2. The Bulgarian version in 1900 [2]

to Macedonian geography.[1] The validity of Kănčev's concept of Macedonia as a geographical region depends upon the criteria used to measure regional affinities. It cannot be denied that Macedonia as he defined it corresponds broadly with a zone transitional in its structural characteristics between the Dinaro–Pindhos and the Rodopi structural provinces, and that it derives a distinctive physiography from the recurring pattern of basin, gorge and high mountain which is met with throughout its territories Its climate is also characterized by unique transitional features, open as the region is to the penetration of Mediterranean influences from the south and yet exposed to continental influences from the north.

But regions of transition are difficult to define with accuracy and when transitional features in physical geography are matched by equally complex transitional features in human geography, the difficulty becomes all the greater. The Macedonian human landscape exhibits a rich diversity which is pre-eminently due to the wealth of its cultural contacts emanating from many sources. The form of habitation is a case in point. Occasionally an Albanian fortified house, or *kula*, may be seen in a Macedonian town standing by the side of a Turkish mansion or *konak* and, perhaps in the same street, there may be a Greek-type villa together with a single-storied, rather primitive Slav *kuca*. But for the

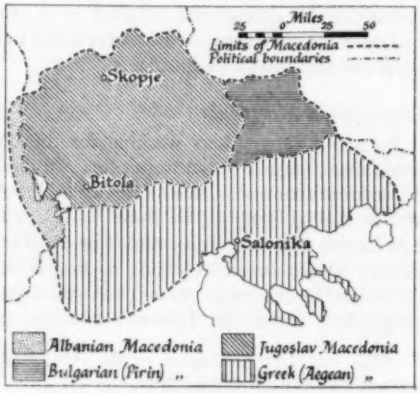
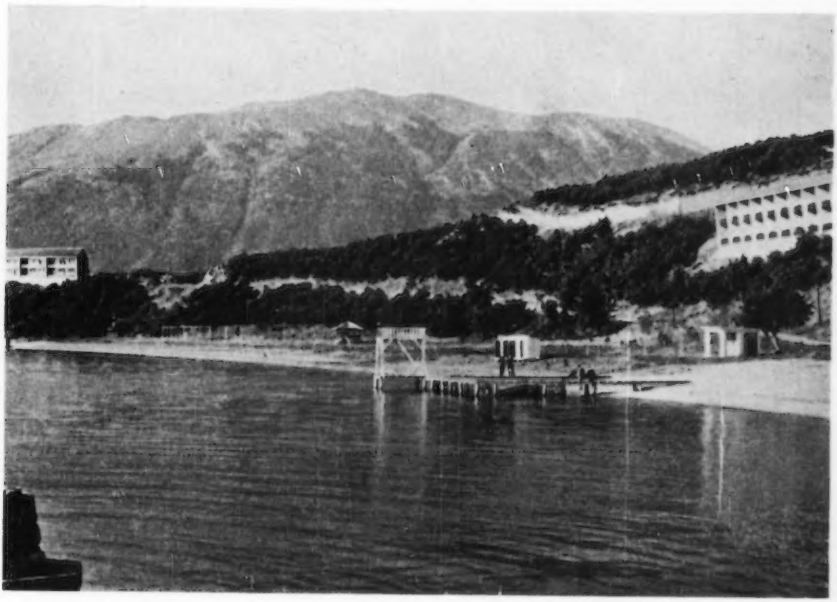


Fig. 3. The Revolutionary Organization version [3]

[1] His views are incorporated in 'Carte de la Macédoine dans ses limites géographiques, à l'échelle de 1 : 3,000,000,' Sofia, 1933.

[2] Based on 'Carte Ethnographique de la Macédoine, Point de Vue Bulgare,' *Enquête dans les Balkans* (*Paris*, 1914).

[3] Based on a map in R. Busch-Zantner, *Bulgarien, Geschichte und Politik im Zentrum des Balkans* (*Leipzig*, 1941).



1. Lake Prespa, Galičica Mountains, and buildings of Oteševa tourist centre

2. Skopje, with citadel in background sited on river bluff

3. Struga, decayed market town on Albanian frontier

4. Threshing sesame. Basic problem is agricultural over-population

most part styles of architecture are mixed, and individual houses may incorporate many contrasting features in the one building. And so it is with clothes. The Turkish fez, the white Albanian *plis*, the black sheepskin *gougla* of the Macedonian Slav offer contrasts in headgear; but individual dress as a whole, in addition to being modified by western European influences, is often a mixture of many fashions; Turkish, Slav, Greek and Albanian. The Macedonian *cuisine*, characteristically, has to cater for many tastes, and its menu offers such palatable contrasts as slivovica and sweet Greek wine, paprika and Turkish sweetmeats. In the bazaars, which echo to the babble of half a dozen different languages, the rich cultural diversity of Macedonia is more immediately apparent; and there the plaintive melodious notes of the Slav folk songs mingle with strident oriental music and the skirl of the native Albanian bagpipes.

This amalgam of cultures is a reminder that historically Macedonian relations have been as close to the continental empires which have waxed and waned in the heart of the Peninsula, as they have to those which found the milieu for their expansion in the eastern Mediterranean. Its association with Turkey was the most recent but not necessarily the most important of its many connections. Bearing all these facts in mind, any limits chosen to define Macedonia must always prove unsatisfactory from one point of view or another. Kănčev elected to place those limits on the Šar Mountains and along the Mesta River in the east, on the peaks of the Pindhos, Grammos, Jablanika and Korab in the west, and along the Aegean coast in the south. In his choice of limits he was moved by the necessity of rationalizing Bulgarian claims to a large stretch of territory which Bulgarian politicians wished to control for strategic and economic reasons. His definition stuck, not because it was based on profound truths, but because it was plausible and it happened to satisfy a need. Man, not nature, gave Macedonia its regional boundaries. The very vigour with which Greek and Serbian scholars subsequently attacked Kănčev's thesis was one indication of its success. It is also certain that however questionable Kănčev's thesis might be, it did exert a profound influence on later events. In 1913, when boundaries were drawn through so-called Macedonia, not only Bulgarian geographers but those of other nationalities referred to its "unnatural" partition. Macedonian geographers have written recently in a similar vein, stressing the geographical unity of Macedonia. The move for a "Greater Macedonia" is based upon the claim that Aegean [1] and Pirin Macedonia [2] are naturally a part of Jugoslav Macedonia.

The Macedo-Slavs and the Macedonian nation

Another development which succeeded in giving reality to the modern concept of Macedonia, and which ultimately played its part in provoking agitation for Macedonian autonomy, concerns the ethnic composition of its population. There was, during the nineteenth century and later, an enormous output of propaganda on the issue of the ethnic affinities of the Macedonians,

[1] J. F. Trifunoski, 'Jegejska Makedonija,' Belgrade, 1946.

[2] D. Mitrev, 'Pirinska Makedonija vo Borba za Nacionalno Osloboduvanje,' Skopje, 1950.

but the preponderance of the Slav element, whether it was called Slavophone Greek, Serb or Bulgarian, was generally recognized. But after 1890 there was a novel development in the ethnic controversy when the term "Macedonian" began to be applied to the Slavs of Macedonia, instead of their being called Serbs or Bulgarians.[1] J. Cvijić's work on the ethnography of Macedonia was important in this respect. His idea of the "Macedo-Slavs" was first brought to the notice of a wide public in 1906,[2] and ultimately it was largely instrumental in dissociating the Slavs of Macedonia from the Bulgarians. Indeed, to achieve that dissociation was precisely Cvijić's objective. Until his ideas became widely accepted, public opinion had been favourably inclined to an acceptance of the Bulgarian thesis—that the Macedonian Slavs were Bulgarians (Fig. 2). Bulgarian propaganda had been so successful in Macedonia at one time that H. N. Brailsford wrote in 1906, "As things are to-day the Serbian consuls are about as likely to win Macedonia for the Serbians as the American missionaries are to convert them to Protestantism." [3] Cvijić insisted that the Slavs of Macedonia were transitional in character between Serbs and Bulgarians, and he went on to assert that they had no "national consciousness"; that they could just as well be regarded as incipient Serbs, as Bulgarians. Cvijić's contention was that their inclusion within Serbia would be sufficient to ensure the development of Serbian nationality amongst them. He was proved wrong by events but his concept of the Macedo-Slavs survived and was instrumental in producing a Slav element in Macedonia distinctive from either the Bulgarian or Serb elements, in spite of the fact that his views on the distribution of the Macedo-Slavs varied in his several maps (Fig. 4).

Macedonian nationalism began as a purely external movement led almost exclusively by a few Macedonians living in Bulgaria; secret societies, organized with the connivance of the Bulgarian Government, were a special feature of its early history. One of these societies, "The Macedo-Adrianople Committee," addressed a memorial to the Great Powers in 1895 on behalf of the Macedonians, in favour of "an autonomous Macedonia, with its capital at Salonika, to be placed under a Governor-General of the predominant nationality." But the most notorious of the secret societies, IMRO, professed to be purely Macedonian and claimed to operate on Macedonian soil from its inception in 1893 until the Balkan Entente of 1933. It did however have bases in Bulgaria. Finally, its terrorist activities, designed to give publicity to the movement, brought it into disrepute even with the Bulgarian Government. Although IMRO failed to capture the imagination of the Macedonian peasantry, it left behind a political programme for the emancipation of Macedonia which still has its adherents to-day. This programme comprised the formation of an autonomous state similar in extent to that envisaged by Kănčev (Fig. 3). The Communist Governments of Jugoslavia and Bulgaria found in the programme a ready-made instrument for use in their attempt to gain control of northern Greece between 1945 and 1948.

[1] The term was used in an ethnic context by T. Fischer, 'Länderkunde der drei Südeuropäischen Halbinseln,' Wien, 1893.

[2] 'Remarks on the Ethnography of the Macedo-Slavs,' London, 1906.

[3] H. N. Brailsford, 'Macedonia: its races and their future,' London, 1906.

A more important development in Macedonian nationalism was the romantic and literary movement led initially by a few intellectuals and men of letters, such as J. Krcuski, G. Puljevski and K. Sapkarov. They concerned themselves with the revival of the Macedonian dialect, which in the latter part of the nineteenth century had begun to be modified by contact with the Serbian and Bulgarian languages. They also aimed at the development of a Macedonian literature which alone could ensure the survival of the dialect. The "literary renascence" as it was called, suffered a severe setback in 1913 when political boundaries were fixed in Macedonia as a result of the Balkan Wars. Both the Serbian and the Bulgarian governments insisted upon the use of their respective literary languages in those parts of Macedonia which fell under their control. But Macedonian Slavs in Greece, far from being encouraged to write their own language, were not expected even to speak it. In Bulgarian Macedonia, the Macedonian dialect was close enough to the Bulgarian language for the policy to succeed, but in Serbian and Greek Macedonia the measures taken to repress the use of the local Slav dialect aroused widespread hostility and resentment. This did more to foster a sense of national consciousness among the Slav population than any dozen secret societies had done in the past.

The question of minority rights for the Macedonian Slavs was raised at the Peace Conference in Paris in 1921, but President Wilson himself declared that the principle of "self-determination" could only be applied to the territory of the defeated powers, and it was not the business of the Peace Conference "to inquire into ancient wrongs." [1] Nevertheless, proposals were made by the Italian delegates for the creation of an autonomous Macedonia. British and French delegates opposed the proposition on the grounds that it impugned Greek and Jugoslav sovereignty and that its creation could only aggravate political instability in the Peninsula.[2] With the opening of the Second World War the Macedonian national movement received a great stimulus from an unexpected quarter. The German Foreign Office in accordance with its policy of making systematic use of dissident minorities in Eastern Europe in order to extend its sphere of influence in that territory, paid special attention to Macedonia. An interesting map, prepared by German geographers for the German Foreign Office, depicted the distribution of various categories of Macedonians in some detail (Fig. 4). Great publicity was given in the German press and in scientific journals to Bulgarian and Macedonian aspirations. When Jugoslavia was dismembered in 1941 the greater part of its Macedonian territory was attached to Bulgaria. Although this move did not satisfy the autonomists it found favour with many Macedonians, in spite of the loss of western Macedonia to Albania, which the revision of boundaries entailed.

But the new regime brought disillusionment and hardship, and the Bulgarian Government soon experienced a great deal of underground opposition to their rule in Macedonia. Paradoxically, the Bulgarians fell victim to their own propaganda. They, who had so assiduously cultivated Macedonian

[1] H. W. V. Temperley, 'History of the Peace Conference of Paris,' Vol. 2, p. 433, London, 1921.

[2] M. Lorković, 'Das Recht der Makedonier auf Minderheitensschutz,' Berlin, 1934.

autonomy in the past, were least prepared to acknowledge its existence when confronted by it. Bulgarian policy seemed to be based on the assumption that nothing had happened in Macedonia since 1913, and this assumption cost them dear. The long awaited union of Macedonia and Bulgaria served but to give further impetus to the development of Macedonian nationalism. It spelled the end of Serbian cultural influence in the territory which changed hands and, just as consequential, it cut the knot which had so long joined the Macedonians and the Bulgarians.

When the Jugoslav communists operating against the German and Bulgarian armies of occupation began to extend their activities to Macedonia, they successfully solicited Macedonian aid with the promise of federal autonomy and complete cultural emancipation when the battle should be won. And it was in accordance with this policy that the Federal Republic of Macedonia was established as part of Jugoslavia in 1945. A remarkable period of intense activity in the cultural field followed in which extreme measures were adopted to purify the Macedonian language, and to create for it a written form. The alphabet and orthography were standardized. The new language was made the medium of instruction in schools and in the University in spite of the practical difficulties involved. Feverish research was undertaken to purify Macedonia of all Serbian and Bulgarian influences. Macedonians who before the war had adopted the Serbian suffix *ić* in their personal names, changed back to the Macedonian *ski*. Place-names likewise underwent a transformation; Skoplje became Skopje, Bitolj became Bitola and so on. The enthusiastic measures taken to establish a distinctive written language met with the warm approval of the Jugoslav Government, because the close affinity between Macedonian and Bulgarian had hitherto resulted in many Macedonians making use of the Bulgarian written language. A distinctive Macedonian language could be regarded as a guarantee against irredentism. The new written language is immensely popular. There is little doubt that to the man in the street it signifies the birth of the Macedonian republic.

II. THE REPUBLIC'S PROBLEMS AND PROSPECTS

The new republic has a total area of just over 10,000 square miles and is thus a little more extensive than Wales. Its population in 1948, according to the Jugoslav Census taken in that year, was 1,152,054. This amounted to about 7 per cent. of the total population of Jugoslavia. The Census of 1948 also revealed that in spite of great losses of population during the recent war, the Macedonian population had increased by some 23 per cent. over the returns for 1931. The currently high reproduction rates are, indeed, a source of embarrassment in an area where over-population in relation to available agricultural resources is already a formidable and urgent problem (Plate 4). The Jugoslav Government have tried to cope with this problem in what it conceives to be a characteristically Marxist manner by putting into effect with all possible speed and enthusiasm a policy of collectivization and industrialization. As a result, Macedonian society and its economy are in a

process of rather violent transition, the outcome of which it is not yet possible to forecast.

Direction of new enterprise in Macedonia and capital for development must necessarily come from Belgrade, but the relations between the Serbs and Macedonians in the past have hardly been harmonious enough to guarantee the wholehearted acquiescence of the Macedonian peasantry in any plans proposed for the future which might emanate from this source. The Serbs are compelled to handle the Macedonian situation most delicately, and they accordingly adopted a conciliatory attitude over the delineation of the inter-republican boundary. As a consequence, all the claims put forward by J. Cvijić concerning the Serbian character of northern Macedonia were abandoned. The boundary was drawn to follow the watershed of the Šar Mountains as far as the Kačanik Gorge, but leaving the Albanian town of Kačanik, in the autonomous region of Kosovo-Metohja (Kosmet), within Serbia (Fig. 1). East of the Kačanik Gorge the boundary runs to the south of the Vranje salient through the Kara Dag and the mountains of Rujen, then to Mount Kozjak and eastwards to just south of the peak of Bele Vode and so to the Bulgarian boundary. The Slav population north of this line is mostly Serb in speech and sentiment. South of the line the Slavs are largely Macedonian in sentiment, although in the Skopje district Serb influence is still very strong. Various views on the distribution of Macedo-Slavs are shown in Figure 4 and it is of interest to relate these distributions to the inter-republican boundary. They demonstrate the extent to which the Serbs have relinquished their ethnic claims in northern Macedonia.

The Albanian minority

Only some 68 per cent. of the population of the republic is of Macedonian nationality according to the Census of 1948. There are small elements of Turks, Gypsies and Vlachs and a large Albanian minority amounting to some seventeen per cent. of the total population (Plate 5). Because of their numerical strength and the fact that they are replacing themselves more quickly than the Slavs, the Albanians present a disturbing problem to the Macedonians. Part of western Macedonia has been predominantly Albanian from at least the first decades of the nineteenth century. Place-name evidence and research on migrations point to a long-standing shift of Albanian population from High Albania into western Macedonia which has taken place at the expense of the Slavs.[1] Albanians now outnumber the Slavs along much of the Macedo–Albanian frontier. During the war the Italians made use of the ethnic argument to push the boundaries of the Italian protectorate of Albania well into western Macedonia. The Albanian element in the territory which changed hands is far from being reconciled to the idea of being returned to the Jugoslav fold. War-time memories aggravate the traditional animosity

[1] A Macedonian geographer, J. F. Trifunoski, has published a number of papers on this subject, including 'Les villages qui n'existent plus en Polog,' Faculté de Philosophie de l'Université de Skopje Annuaire, Vol. 2. In Serb with French résumé (Skopje, 1949); 'Les familles Macédoniennes de Polog originaires d'Albanie,' *ibid.* Vol. 5, No. 2, Skopje, 1952, and 'Données sur l'origine et les migrations de quelques familles de la Macédoine de nord-ouest,' *ibid*, Vol. 5, No. 5, Skopje, 1952.

between Slav and Albanian. Many Slavs living in western Macedonia in 1940 were either killed or forced to migrate to Bulgarian-occupied territory. Since 1945, Slav migration back into the west has been encouraged by the Macedonian authorities. This the Albanians resent.

A possible solution to the problem would have been the inclusion of western Macedonia in the Albanian autonomous region of Kosmet, but such a solution proved impracticable. In the first place the intervening Šar Mountains do not allow of any close intercourse between western Macedonia and Kosmet and, secondly, the Macedonians would certainly have resented any further "partition" of traditional Macedonian territory. The present strained relations between the Albanian and Jugoslav Governments add to the difficulty of the situation. It would seem that to obviate the danger of Albanian irredentism in western Macedonia a policy of tolerance towards the Albanian minority must be accompanied by the establishment of better relations between the two Governments. Not only the solution of the ethnic problem depends on this, but the proper exploitation of the water-power resources of the Drin river and of the Macedonian lakes. The prosperity of the border towns of Macedonia also depends on the opening-up of the roads across the boundary, and Jugoslav statesmen have always recognized the value of an outlet through Albania to the Adriatic for the products of western Macedonia.

The capital of the republic

The choice of Skopje as the capital of the new republic was fairly obvious although it is only since 1913 that it has outgrown Bitola. The comparative history of the two towns strongly reflects the changing orientation of Macedonia over the years. Thus Edward Lear writing of Bitola, then styled Monastir, about the middle of the nineteenth century, described it as a "little metropolis," and noted the number of vendors and buyers thronging the bazaars and the "reviews, guards, bands of music, pashas, palaces, bustling scenes and heaps of merchandise awaiting the visitor at every turn." [1] Subsequent to 1913, when the "Egnatian Way" was cut by the Albanian boundary and the caravan routes through the "Monastir Gap" by the Greek boundary, Bitola's function as a regional trade centre declined considerably. It also lost its administrative status. Border market towns like Ohrid, Debar and Struga (Plate 3) also languished and none of these towns have yet succeeded in recovering their former prosperity. On the other hand, the northern towns such as Skopje and Kumanovo benefited from the change of boundaries.

Skopje, in particular, has always flourished whenever a close relationship existed between Macedonia and the Slav lands farther north. It became Stefan Dušan's forward capital consequent upon the southern expansion of the medieval Serbian empire. Old Skopje clustering about the citadel on the northern bank of the Vardar is still called Dušan's town (Plate 2). After its occupation by the Turks, Skopje continued to function as a market town and was used by the Turks as a military outpost. In the eighteenth century Ragusan merchants still visited the town, but by the middle of the nineteenth century its importance had declined so much that it was described

[1] E. Lear, 'Journal of a landscape painter in Albania,' London, 1851.

by G. M. Mackenzie as "a decaying and wretched place, its inhabitants sickening under the unhealthy exhalations of undrained marshes." [1]

The occupation of the town by the Serbs in 1913 brought it new life. Skopje became the administrative centre of the Vardarska *banovina*, a military garrison of some importance, and a collecting centre for all goods from Macedonia destined for Serbia. Railways have played an important part in emphasizing Skopje's command of routeways between Macedonia and the rest of Jugoslavia (Fig. 1). It is linked by rail to the Pelagonian basin in the south and to the basins of Štip and Kočani in the east, and a light railway links it with the Polog basin and the Macedonian Lakeland in the west. The rail connections with the rest of Jugoslavia are via the gorge of Kačanik, the route followed by the railway which the Turks built and originally intended to reach Sarajevo; and via the Morava valley, the Simplon-Orient express route.

Skopje's urban landscape provides a striking commentary on the various phases in its growth. Its Byzantine churches with their magnificent frescoes and their fine examples of carving in wood bear witness to the grandeur of medieval Serbia. The Turkish period is reflected in the presence of many mosques, the baths (now an art museum) and the covered market. The extensive Moslem Gypsy quarter with its cramped and squalid dwellings, and the old Turkish quarter with its minute shops dealing in silver filigree leather-dressing, wood-carving and other examples of handicraft serve to remind the European that the Orient begins in the Balkans. The impressive Kuršumli Han is a monument to Skopje's past role as a caravan centre. In contrast to all this is the modern town on the south bank of the Vardar which was largely developed by the Serbs between 1920 and 1940. The Army House in the main square is perhaps symbolic of this period when the Serbs were attempting to permeate Macedonia with their way of life. Skopje's present role is eloquently expressed by the new gleaming building with its hammer and sickle in neon lights, in which the Macedonian Communist Party has its headquarters. Oddly enough this building adjoins the Turkish fortress. The emblems of the old masters and the new stand side by side.

Agriculture

In Macedonia the total cultivated land apart from pasture amounts to some 10 per cent. of the total surface. Physical geography largely accounts for this small proportion. The high incidence of steep slopes, the extensive areas of poor drainage in the bottom lands of the basins, the sandy and friable character of the Neogene deposits which fringe the basins and whose surfaces easily wash away or blow (Plate 7), the difficulty of flood control of the mountain rivers, the vagaries of a steppe climate with its liability to droughts and destructive rainstorms; all these are limiting factors. There is also a constant struggle against soil erosion; gullying, fanning and mudflows occur in the hills and sheet erosion in the basins. In recent years soil erosion has reached menacing proportions in Macedonia, in spite of the fact that the slaughter of stock during the war reduced over-grazing to a minimum.

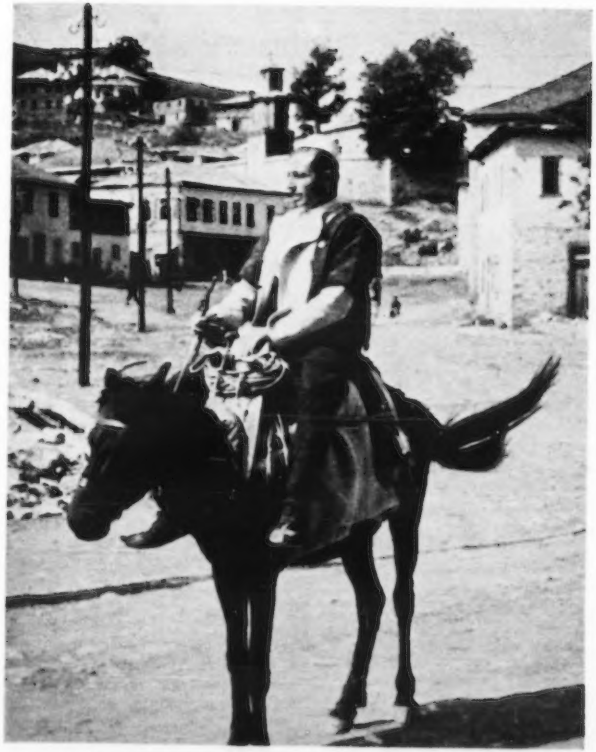
[1] G. Muir Mackenzie and A. P. Irby, 'Travels in the Slavonic Provinces of Turkey,' London, 1867.

An unusual sequence of dry followed by a sequence of wet years may be one explanation of the increased soil erosion. Some Jugoslav geographers are however inclined to the view that soil erosion on this scale is merely a manifestation of recent and continuing rejuvenation.

In the past, Man even as Nature has been responsible for depression in Macedonian agriculture. Insecurity associated with Near Eastern systems of land tenure, the harsh and irresponsible administration of the pashas, the ever constant threat to property during the period of *komitadji* warfare, all combined to make the lot of the Macedonian peasants more wretched than their fellows anywhere in Europe. Endemic weakening diseases, more particularly malaria, were until recently a contributory factor in reducing their efficiency. Now they must contend with state planning in agriculture, which offers them the alternative of being collectivized, or of subscribing to the state levy on agricultural produce. They would hardly be human if they did not look upon these things with a jaundiced eye.

A large proportion of the farms in Macedonia has been collectivized, and this policy has met with mixed success as far as productivity is concerned. In the upland villages where land and stock were traditionally owned in common, this process has not materially altered the way of life, and it has been accepted more readily than in the lowlands. Lazaropolje, situated at a height of some 4000 feet in the Jama Mountains, is an example of an upland village where collectivization has been successful. Considering the fact that the village was destroyed during the war and its inhabitants forced to migrate, its present prosperity is remarkable. Since 1945 not only has the village been rebuilt, but a tolerably good mountain road has been engineered to link it to the main highway in the Mala valley. Other achievements include the erection of a new school (the most imposing buildings in all Macedonian villages are invariably new schools), and the installation of electricity and a piped water supply. A small factory for the manufacture of carpets and woollen textiles has been put into production, and hostels erected for tourist purposes. All this development has been made possible by capital proceeding from the exploitation of the rich upland pastures lying some 1500 feet above the village. Cattle herds, depleted during the war, have been replenished, and the local breeds of sheep improved by cross-breeding with Merino and Karakul strains. Sheep rearing, of course, remains the mainstay of the economy of the uplands.

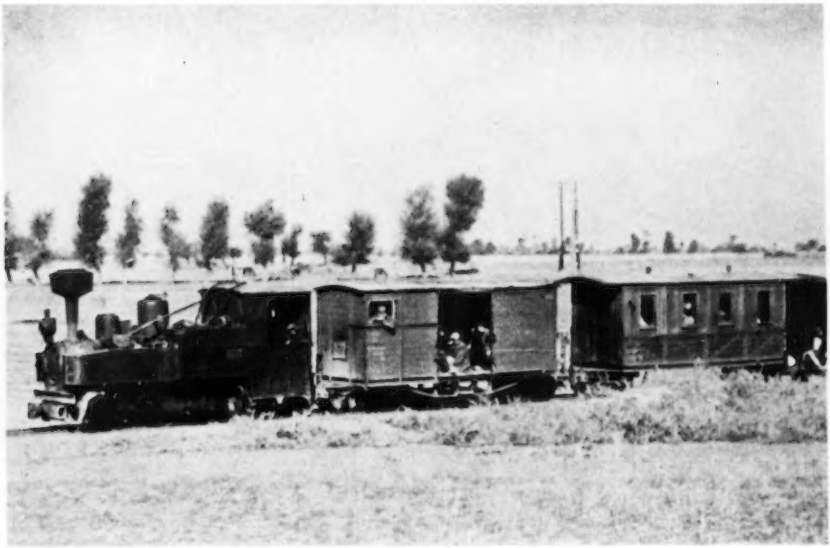
In the lowlands, collectivization has not met with any corresponding success. Like the Bulgarians, the lowland farmers in Macedonia are subsistence farmers strongly attached to their plots of land and reluctant to waive their rights to work them, however small. Methods are primitive, but by a careful tending of the soil the Macedonians contrive to produce as much from the land as it is likely to yield by any other methods of cultivation. The real problem is that there are too many peasants on too few acres. Hence in the past there has been no need for labour-saving devices on the farm or for the employment of tractors. When manpower is cheap and easily available, and everyone on the farm including the women do their share of farm work, there is no call for the replacement of power supplied by hand, by that supplied by machines or even by animals. Under these circumstances collectivization of farms inevitably results in lowered productivity. The chief



5. Albanian mountaineer, from Western Macedonia

6. Moslem Gypsies, unveiled, from Skopje

7. Crni Drim valley, showing rapid erosion of river terraces



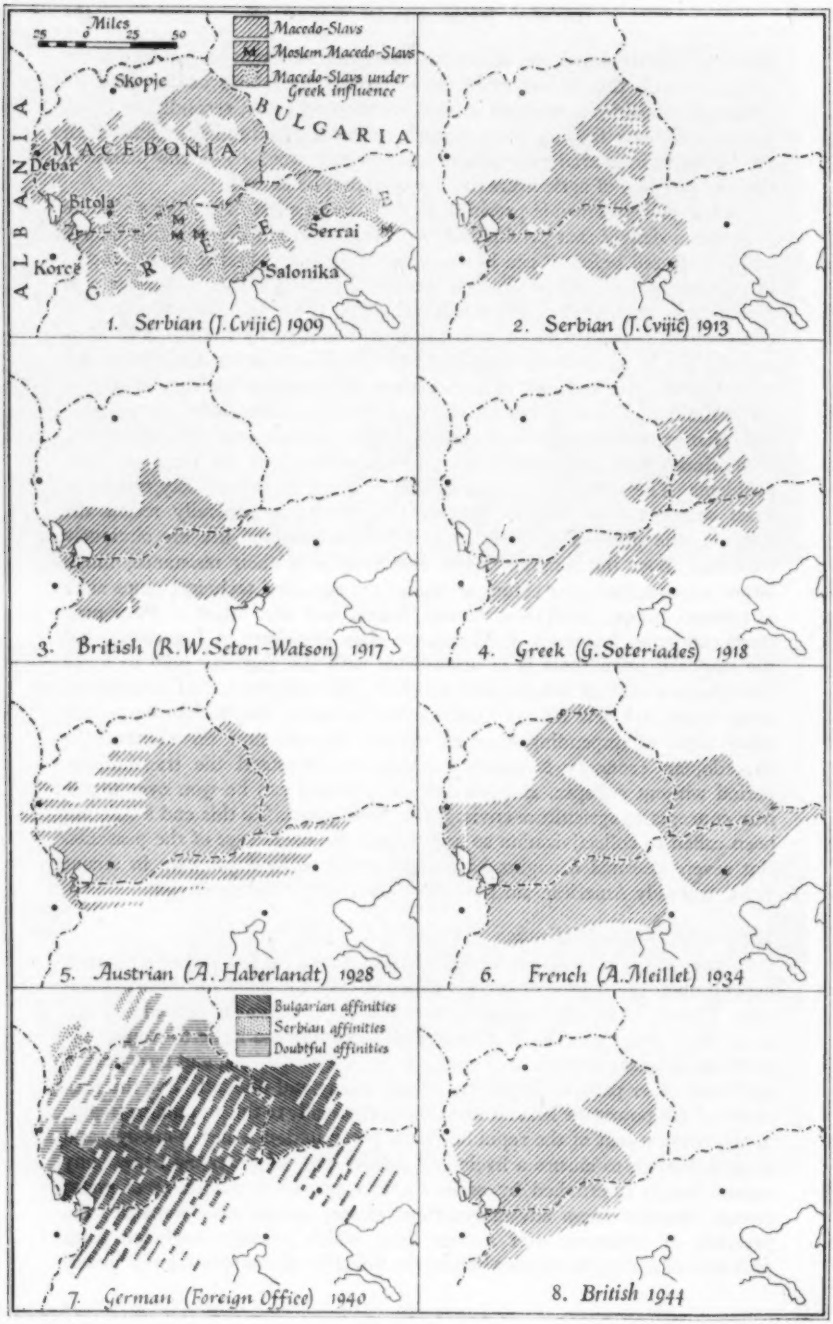
8. The "Ohrid Express", symbol of the need for modern transport

aims of collectivization are, of course, first, not so much to produce more food, although this is important, as to reduce the labour on the land, so making it available for work on industrialization schemes; secondly, to break down subsistence farming by encouraging those agricultural products which are of use in industrial enterprises. Only in this way, argue the planners, can the problem of agricultural over-population be solved.

Such a policy demands precision in the coordination of planning. There is always a danger that productivity in agriculture will decline, that labour will be released before it can be absorbed by industry, and that the process of industrialization will not be fast enough to make good the deficiencies in agricultural productivity. These are calculable risks. But the attitude of a conservative peasantry faced with the destruction of its traditions of agricultural life is incalculable, and a policy of collectivization must allow for their recalcitrance and lack of cooperation. Wisdom and patience are called for in the execution of the plans, and neither of these attributes are particularly characteristic of young and enthusiastic, if well-meaning, revolutionaries. The Macedonian communists are now painfully aware of most of these problems. The economy of the republic is in the throes of hasty transition from subsistence to modern farming. The peasants generally resent the reforms; the plots of land set aside for their personal use are obviously treasured above the common fields. But in spite of their resistance, much larger acreages than ever before are under the so-called technical crops such as tobacco, poppy, sunflower, sesame, cotton and rice. Most of these products can better be grown in Macedonia than elsewhere in Jugoslavia, and the emphasis upon them is in accordance with the Jugoslav plan to make Macedonia a zone of sub-tropical produce. The appearance of tractors on some farms and new herds of dairy cows to replace the buffalo herds, are other signs of impending changes. Much depends now on whether the Macedonian economy is resilient enough to withstand the transitionary period without collapse, and whether the peasants can be won over to the new concepts of agriculture envisaged in State plans. To this end a halt has been called to collectivization so as to regain the confidence of the peasants. But severe seasonal droughts have aggravated the food problem in recent years, and only American aid has helped to counter food shortages.

The process of industrialization

In the end, the solution of agricultural problems in Macedonia must depend upon the degree of success which attends the plans for industrialization. The development of the hydro-electric resources of Macedonia has been given priority in the planning of industry because hitherto Macedonia has been deficient in power resources. It has very little coal, and transport of coal from other parts of Jugoslavia is both costly and difficult. For the provision of this power the Macedonians look principally to the mountain streams of the western half of the republic. Here precipitation is heavy enough and reliable enough to ensure a lively and regular flow of water, and the many upland basins interlinked by narrow gorges provide possibilities of water storage. Against these advantages must be set certain disadvantages; the presence of limestone over a wide area, which presents engineers with problems of sealing the storage basins; the difficulty of transporting machinery


Miles
25 0 25 50
Macedo-Slavs
Moslem Macedo-Slavs
Macedo-Slavs under Greek influence
Skopje
BULGARIA
ALBANIA
MACEDONIA
Debar
Bitola
Serrai
Korçë
Salonika
1. Serbian (J. Cvijić) 1909
2. Serbian (J. Cvijić) 1913
3. British (R. W. Seton-Watson) 1917
4. Greek (G. Soteriades) 1918
5. Austrian (A. Haberlandt) 1928
6. French (A. Meillet) 1934
Bulgarian affinities
Serbian affinities
Doubtful affinities
7. German (Foreign Office) 1940
8. British 1944

and materials and of finding accommodation for workers in the uplands; and the problems of transporting electricity for long distances once it has been generated.

The great possibilities for the creation of hydro-electric power in western Macedonia were recognized by the Serbs in the period between 1918 and 1939, and the construction of the Treska plant with an output of 3500 kilowatts was successfully undertaken before the war. This scheme has served as a model for similar ventures which have been initiated in the last four years. Of these, the most ambitious is the Mavroro scheme, which involves a modification of the present watershed between the Vardar and Radika river systems. The headwaters of the Radika are being diverted to fill the ancient lake basin of Mavrovo and an earth barrage is being constructed across the present outlet of the basin to conserve these waters. They are then to be led by a system of tunnels and open canals down into the Polog basin. It is calculated that the power-houses, some at the base of the tunnel and others farther down the valley, will between them have an output of some 200,000 kilowatts when the scheme is completed in about two years' time. Some of the smaller projects, like the Pesočani hydro-electric plant in the Kara Orman, are already in operation. This plant consists of two generators powered by stream-fed twin pipelines having a drop of about 300 metres, and carrying some one and a half cubic metres of water per second. The plant, with a capacity of 3500 kilowatts, has taken about three years to construct, largely because of the difficulties of transport.

It is interesting to observe that most of the hydro-electric projects are being directed by Slovenes with the aid of local labour. The training of skilled personnel to make use of the electric power when it is available is a major problem confronting the Macedonian authorities. Illiteracy is widespread, and time will inevitably be needed before measures now being taken to improve general educational standards begin to have their effect. The University of Skopje has been expanded, and technical schools have been established in the chief towns. But these institutions are at the moment top heavy. There is no suitable recruitment from below, and always present is the difficulty of combating the drain of skilled labour from Macedonia to other parts of Jugoslavia. The flow of population in Macedonia has always been outwards, due largely to the sharp contrast in standards of life between it and other parts of the country.

Fig. 4. Some views on the distribution of the Macedo–Slavs

J. Cvijić's distributions (maps 1 and 2) varied in each of the interpretations he put forward. The validity of his maps and of the others in this series are discussed in detail in H. R. Wilkinson, 'Maps and Politics: A Review of the Ethnographic Cartography of Macedonia' (Liverpool, 1951). No general agreement on the precise distribution of the Macedo–Slavs is to be found from a study of the maps. For example, in maps 4, 6 and 7, the whole of Pirin Macedonia is shown as Macedonian, in map 5 only a portion of it is, while in 2, 3 and 8 little or no Macedonian territory at all is shown in Bulgaria. There is a big contrast between distributions based on the situation before and after the Graeco–Turkish population exchanges of 1922–26—compare, for example, the two British maps, 3 and 8. It can be concluded that Macedo–Slavs are probably the predominant ethnic element in the frontier regions between Jugoslavia and Bulgaria, and between Jugoslavia and Greece.

Industry can, however, benefit on a short-term basis, from the traditional skills inherent in the population. The working of metal and wood and the spinning, weaving and embroidery of textiles have long been practised throughout the republic on a domestic basis. Attempts are now being made to utilize these skills for the mass-production of light engineering products, furniture and textiles. Some progress has been made with the manufacture of agricultural machinery, and a few plants are in operation, the largest of which is in Skopje. The refining of locally mined ores too, offers certain possibilities. Macedonia, for example, produces more chrome than elsewhere in Jugoslavia, and has the biggest single mine at Raduša. But the most successful instance of the conversion of domestic to factory labour is in the manufacture of textiles. Skopje already has its textile industry well established. Large mills have been inaugurated for the manufacture of woollen textiles at Tetovo, for silk at Titov Veles and for cotton at Štip. Smaller enterprises, such as the textile factory at Lazaropolje, are being set up in the villages.

A variety of industries associated with local agricultural products, have become characteristic of nearly all the Macedonian towns. They are given every encouragement because they afford a speedy and ready means of diversifying the Macedonian economy at a low cost. These industries include food-processing, leather-dressing, the manufacture of opium from poppy, the extraction of oil from sesame and of nicotine from tobacco, and of course, the curing of tobacco and the manufacture of its products. Tobacco is the mainstay of the Macedonian economy, and the republic grows some 60 per cent. of the total tobacco crop of Jugoslavia. Its tobacco is the aromatic variety with a small leaf, and is of quite high quality. The Prilep basin is the chief centre of tobacco production, and here the plants yield as many as fifteen pickings a year. Prilep itself has one of the largest curing and packing stations of anywhere in Europe. Most Macedonian towns have at least one tobacco warehouse, and in addition much tobacco is cured domestically. A high proportion of Jugoslavia's cigarettes is manufactured in Skopje.

But the Macedonians may have to pay dearly for their tobacco industry. In some districts half the arable land is under tobacco in spite of the local deficiency in cereals. In the past the exhaustion of potash and the consequent soil erosion experienced by Maryland and Middle Virginia in the U.S.A. have illustrated the danger of intensive tobacco culture. So the future of the tobacco industry is rather precarious. For one thing, the Government have found the tobacco tax a profitable source of revenue. Secondly, and more important, it is difficult for Macedonian tobacco products to find a permanent market outside Jugoslavia, partly because in the bigger tobacco markets the Virginian is still preferred to the Turkish variety. Any recession in the tobacco trade must certainly hit the Macedonian economy very hard and would undoubtedly create a major depression. This is because tobacco is the chief cash crop, not only of the collectives but of the mass of the free peasantry as well.

The problem of transport; the tourist industry

Macedonia suffers at the moment from considerable deficiencies in its system of transport, which seriously interfere with plans for the improvement of its

economy. The problem is a double one. First of all, the whole system of internal transport is primitive by western standards, and is unable to stand up to the new demands now being made upon it (Plate 8). Secondly, Macedonia's interior position means that trade with countries overseas, and even with the rest of Jugoslavia, is a costly business. Amongst the many factors which limit ease of transport in Macedonia the geographical factors are of prime importance, and are permanently applicable. Sheer distance, not only from the interior to the ports, but between one town and another, is a factor in itself. Population is too sparsely distributed to carry a close network of railways, and the relief of the land makes the construction of every motor road a major feat of engineering; there are no open valleys, and the gorges must be avoided by ascending to heights of anything up to 3000 feet. Landslips, mudflows and other features of soil erosion have to be contended with on the mountain roads. Even in the basins, fanning frequently covers the highways with stones. The railways, too, suffer from processes of erosion; so much so that in recent years great difficulties have been experienced in keeping open the Simplon–Orient Express route.

Inefficiency in the construction and maintenance of communications is another factor contributing to transport difficulties. This can be overcome; but in the meantime it aggravates the problem. Road surfaces are badly made and in the vicinity of towns where there is heavy traffic, potholes in the main roads reduce the speed of motor traffic to a crawl. Finally there is the political factor—the limitations imposed upon Macedonian exits to the sea by the existence of the Albanian and Greek political boundaries. This is a problem which can only be solved by negotiation between the countries concerned. The drive on the part of Serbia to gain control of northern Albania in 1913, and the more recent but abortive campaign for a "Greater Macedonia" sponsored by the Jugoslav Government, reflect the importance attached by it to economic as well as strategic outlets to the Adriatic and to the Aegean. One thing at least is certain. The prosperity of much of southern Jugoslav Macedonia is dependent upon close cooperation with Greece.

Any consideration of Macedonia's future must contain a reference to its incipient tourist industry. The holiday centres so far constructed, such as those at Oteševa and Ohrid on the Macedonian Lakes, are catering only for internal needs (Plate 1). Difficulty of transport, and the inability of the average Macedonian host to think in terms of western cleanliness and comfort, make it extremely unlikely that large numbers of foreign tourists will visit Macedonia for some time to come. But potentially Macedonia has a great future as a centre of attraction for the tourist who seeks a little more even than the grandeur of its mountains, the beauty of its lakes, the artistry of its church paintings and the exotic imprint bequeathed to the landscape by the Turkish occupation. The processes of industrialization and reform have not yet destroyed the illusion that in this part of Europe time has stood still for four hundred years. There can be few parts of the continent where the traditions of peasant life still flourish in such a vital manner. It is the appeal of the almost biblical simplicity of rural life that gives Macedonia its charm. That the illusion may ultimately be destroyed by closer contact with the material benefits of western civilization gives it added attraction.

TOYNBEE AND HUNTINGTON: A STUDY IN DETERMINISM

O. H. K. SPATE

AT FIRST SIGHT it may appear strange to link the names of Toynbee, who has been praised for 'putting Man back into history,' and of Huntington, usually and on the whole rightly regarded as a thorough-going environmentalist. Yet Huntington makes larger allowances to human initiative than is often conceded, while the exalted idealist tone of much of Toynbee's book tends to mask its large elements of determinism. Both 'A Study of History' and 'Mainsprings of Civilization' have as their central concern the tracing of pattern in history; and that in itself implies a measure of determinism. Naturally the spatial bulks larger in Huntington, the temporal in Toynbee; but as both take the world for their parish and recorded history (and even more) for their period, this distinction is rather formal.

Admittedly their differences are not slight. First, perhaps, is the simple fact that Toynbee is a great writer and Huntington is not. At times indeed the writer in Toynbee runs away with the thinker; a great part of his appeal lies in beauty of style and, beyond that, in the immense and ordered architecture of his work. Beside Toynbee, Huntington looks narrowly 'scientific,' in the pejorative sense in which the word is still used by some old-style humanists; even, perhaps, a little parochial.

The strong and weak points of the two authors are complementary. Toynbee's special failing from a geographical point of view is a looseness of touch, amounting at times to positive misunderstanding, when dealing with the concrete facts of environment, which of necessity play a large part in his work; but we can hardly imagine the author of 'The Pulse of Asia' carrying the Eurasian steppe up to the Arctic circle, as Toynbee does (I, 254), though it is true that he somewhere has the delightful slip of "the Sikhs of mountainous Sikkim." [1] Conversely, when Huntington treats of such immense movements of the human spirit as the great religions, his approach is far too external, lacking the sympathetic insight so often displayed by Toynbee. However this detachment really means less rather than more objectivity, since Huntington is so thoroughly inside his own movement, so emphatically a man of his own American Century. Toynbee also is a man of his time and place—Western Europe beginning to doubt its liberal humanism. But these very doubts mean that he is the more easily able to transcend his own outlook when occasion demands—or at least some occasions, for his lack of sympathy

[1] References in the text are normally to the pages of Somervell's admirable abridgement of Toynbee, followed by the volume and pages of the original (where only volume and page are given, the passage does not appear in the abridgement); or to 'Mainsprings of Civilization,' taken as the culmination and summing-up of the forty years' work since 'The Pulse of Asia.' Quotations from Toynbee and Huntington in double quotes, from other authors in singles. Unless otherwise stated, environment means physical environment.

with some of his scapegoats (rationalists and revolutionaries, for instance) goes far to prevent him understanding some important makers of history. But, while Huntington pays sincere tribute to things of the mind and spirit, it is yet not altogether caricature to suggest that to him civilization is too much a matter to be measured by the number of cars and radio sets and public libraries. This vitiates much of his observation, despite its acuteness, of those numerous times, peoples and places that do not readily fit into this scheme. Typical is the unquestioning acceptance of activity as in itself a good, with very little regard to what it is good for (299, 303, 328–9), culminating in the extraordinary tissue of good sense, half-truths and plain fatuity with which he writes off Hinduism and Buddhism (288–91, 297–9).

Huntington's determinism is avowed, and clearly based too much upon a part only of the immense complex of factors which have gone to the making of history; though it should be added that he is aware of this, and it is his disciples rather than himself who threw discretion to the winds, particularly of course the winds of the cyclonic westerlies. By and large Huntington's mainsprings are biological and physical-environmental, Toynbee's psychical and social-environmental. Essentially Toynbee hardly takes a wider sweep through space and time than Huntington, and his determinism is less explicit, in fact disavowed; yet it none the less exists. His stated aim is "the application of the scientific technique, the elucidation and formulation of laws" (47/I, 455–8), and I cannot see how one can altogether avoid determinism here. Laws imply at the least chains of causation which may perhaps be short-term *sub specie aeternitatis* but very long indeed in relation to the life of human societies.[1] There is in fact implicit in Toynbee's whole system (because it is a system) a sort of determinism of stage, situation or formula: Challenge-and-Response, Rout-and-Rally, Withdrawal-and-Return, and the whole apparatus of universal states and churches, internal and external proletariats, times of troubles and the rest. It is true that the method is by no means so rigidly scientific as this rather esoteric terminology would suggest: there is too much speculation on the inner meaning of myths, and far too much argument from analogy.

Above all, at what may be called the major crises of his work, Toynbee seems deliberately to turn his back on his own logic. It is God, not Man, that he here puts back into history. This is in a sense perfectly valid, since any view which implies progress—or even pattern—presumably implies purpose also. But it certainly sorts ill with the general logic of Toynbee's system (not to mention such asides as the denunciation of "theistic determinism" (448/V, 429–31). On the background of the generally naturalistic procedure, too, such apocalyptic passages as the discussion of "Transfiguration" (526–30/VI, 149 sqq.) appear to some readers at least as entirely unconvincing anomalies. Thus there seems to be a gigantic contradiction pervading the whole work, and the dialectic necessary to resolve it is overstrained.

The general impression is of a pattern in each author too rigid and, in Huntington at least, too much based on a part only of the relevant factors.

[1] The well-known ambiguity of the phrase 'laws of science' is irrelevant here. The life of a 'law' may be short indeed; it is the idea of the existence of real tendencies and pattern which is in question.

This impression is of course subject to large qualifications for both writers, but on the whole I think it valid, and for Toynbee not necessarily disposed of by his own disclaimers. It is long since Hume pointed out, in a parallel case, that Bishop Berkeley proved so much too much that he produced a sceptical reaction precisely opposite to his own intent.

Many good judges, reading our authors, have felt that it is all a little too perfect, and that the sequences fall into place with a precision not quite warranted by the facts adduced. Then there are the facts which, in the nature of things, are not adduced: in Huntington especially there is no autonomy in the great movements of history, which are reduced to impersonal and even non-human forces and trends. But this assumes an inevitability for which we have no real warrant, however little we incline to see history as all made by the more or less irresponsible actions of great men, or however confident we may feel that, given certain relations of world-setting and of human material, the broad outlines of man's story would have worked out much the same despite local mutations.

Here we tread dangerously upon the verge of profound issues. Yet the problems of chance or free will or necessity must be faced in some fashion, though it would be folly on my part to proceed into them very far. Huntington seems to sum the position up when he states (292) that in our daily practice we all follow an intermediate position between absolute freedom and absolute necessity; a compromise perhaps untenable logically but pragmatically workable. These matters are not so irrelevant as may seem. It is not the function of the geographer to write philosophy; but, if he aspires to be more than a competent routine technician, it is certainly one of his responsibilities at least to be aware of philosophical problems which may bear upon his work. His attitude to this most fundamental general problem can hardly fail to have its effect upon his thinking on the more restricted question of geographical determinism versus possibilism.

Toynbee and Geography

Some of the general doubts which a study of Toynbee raises have been indicated. They are largely inherent in his approach, in the attempt to ascertain a general scientific law, or laws, of civilizations. But the establishment of such a law raises a dilemma, since it clearly has a necessitarian cast which as clearly conflicts with an ideological preoccupation not always explicitly stated, but very definitely present. This is the altogether natural desire to find a way out for the Western world from the impasse into which it seems to have got on Toynbee's, or indeed on anybody's, principles; an impasse into which, if my reading of 'A Study' is correct, it has not simply wandered, but to which it has come by the regular progression which he has traced through the other civilizations.

Yet here lies the deepest and most abiding interest in Toynbee's work; the actual pattern-making, brilliant as it often is, does not differ in kind from that of half a dozen thinkers before him. 'If the task of history is supposed to consist in ascertaining general laws governing the course of historical events, it is expurgated of three factors which are in reality of high importance: chance or accident, free will, ideas or the demands and conceptions of

men.'[1] The real crux in Toynbee is his attempt to reassert at least the last two within the framework of his laws. That the attempt, despite the dazzling skill with which it is conducted, appears on the whole a failure cannot detract from its surpassing interest. It is only when we judge not by our own usual standard but by the highest—of which 'A Study' is itself a touchstone—that we are entitled to pronounce the adverse verdict which I think must be pronounced.

But Toynbee is open to decided criticism on a different plane, that of empiric fact. Although Collingwood remarks, rather oddly, that what he takes to be Toynbee's fallacies 'only' affect fundamental principles and rarely distort his judgement in detail,[2] from the standpoint of the working historian Geyl has made out a strong case not only against Toynbee's schematism, but also against the selection of facts on which such a system must inevitably be based, unless it is so surrounded by qualifications as to lose shape and identity.[3] Toynbee is not without defences on this score, but still it can scarcely be denied that in some contexts his selectivity goes much too far. Here we can refer only to the extraordinarily one-sided view of modern English history which is essential if his application to it of the formula of Withdrawal-and-Return is to make sense (235–9/III, 350–63 and 366–8). A footnote suggests that Toynbee himself had qualms here, and certainly to claim the Revolution of 1688 as a creative act rendered possible by isolation from continental entanglements reaches an extreme height of dialectic. As Geyl inquires, 'have William III and his Dutchmen been forgotten?' It was perhaps tactful of Somervell to omit this instance from the abridgement.

Of more significance to our present purpose is Toynbee's handling of environmental concepts, which underlies his discussion of the origins of the earlier civilizations, and especially of the formula of Challenge-and-Response —a stimulating concept, but perhaps neither altogether novel nor paradoxical, except when so paradoxically applied as to be positively unsound. Toynbee here treads too confidently over ground which he has perhaps reconnoitred rather than surveyed. It is not a matter of passing reference, where slips might be condoned; scores of pages in the first two volumes (or about 13 per cent. of the whole abridgement) deal with matters which are geographical or nothing. A preliminary caveat may be entered against the choice of sources. The general discussion of environmentalism is based almost solely upon Hippocrates, who after all wrote some little time ago, and on Demolins, who is set up in order to be knocked down again without a hint that Demolins is hardly an accredited representative of modern geography. On special topics Lattimore and Huntington are cited, the latter extensively, while writers such as Myres and Childe, from the marchlands of our subject, are also drawn upon. But apart from two references to Griffith Taylor and one to Bowman, I can trace no citations from any other geographers; the French school might

[1] R. G. Collingwood, 'The Idea of History,' 177; the whole criticism of modern German historiography (pp. 176–83) is very pertinent.

[2] *Op. cit.* 159–65. This remark reads strangely beside Collingwood's own dictum on the entirely false distinction between 'the humble office of ascertaining the facts . . . and the nobler task of discovering the laws.'

[3] P. Geyl, "Toynbee's System of Civilizations," *Journal of the History of Ideas*, 9 (1948) 93–124.

never have been, though Vallaux and Febvre at least have surely some things pertinent to Toynbee's scheme.

These geographical pages include such views as that the Jordan is simply a smaller Nile; that the Nilotic environment is reproduced in the valleys of the Rio Grande and the Colorado; that the seventeenth century environment of New England was the hardest along the Atlantic seaboard of North America; that the aspect of the Roman Campagna after the decline of its agriculture shows us what the original "dour" environment was like, and that the Danube basin has "much the same distribution of climate and soil and plain and mountain" as that of the Hwang-ho.

I do not propose to traverse all these assertions in detail, but brief comment may be made on one or two. The Jordan, for example, has only 1 per cent. of the annual discharge of the Nile, with nothing comparable to the Nile flood regime, while its valley is far less well endowed than that of the Nile as regards both terrain (much of which is dissected) and soils. Many of these are coarse and porous and lie on terraces well out of reach of irrigation; to say nothing of the stimulating climate of a walled-in valley 1000 feet below sea-level. All Palestine has about 1000 cubic metres of water per inhabitant (about $1\frac{1}{2}$ millions) against 5000 cubic metres of Nile water for each of Egypt's 17 million people.[1] The further comparisons with the Nile overlook the structure of its valley, in which coarser sediments are trapped in the upper basins but not the fine basaltic silts brought by the Blue Nile. The other rivers may be dismissed in a sentence from Russell Smith: 'the Tigris and the Colorado, fresh from the canyon, are ditch-chokers.'[2] Again, in North America the French base in Quebec is far harsher climatically than New England, with 120 to 150 frost-free days against 150 to 180; and indeed Toynbee discovers later on that New England is within the optimum climatic area of the Atlantic seaboard.

It seems likely that these formulae were arrived at after a brief empirical survey of the facts, but that the essential step of detailed verification of hypothesis against fact has been sketchy: one cannot avoid suspecting glance-at-the-map geography. One valley is much like another valley, one desert like the next, islands are islands wherever they are. These are the over-simplified comparisons that Febvre dealt with so faithfully. Nile, Jordan, Colorado on a par: the argument is not new: 'If you look in the maps of the 'orld, I warrant you shall find that the situations, look you, is both alike. There is a river in Macedon, and there is also moreover a river at Monmouth, and there is salmons in both.' The uniqueness of the Nile flood regime and the Etesian winds, so important to the navigation which held together the Egyptiac civilization, are not so much as mentioned; perhaps for good reason, for once the Nile is recognized as unique, one of Toynbee's main arguments against environmentalism falls to pieces forthwith. But even waiving these peculiarities of flood and wind, the argument may be challenged.

This argument is in essence a back-handed attempt to dispose of environmentalism by attributing to it an automatic functioning that few, if any,

[1] E. C. Willatts, "Some geographical factors in the Palestine problem," *Geogr. J.* 108 (1947) 145–79; reference at p. 166.

[2] J. Russell Smith and M. Ogden Phillips, *North America* (1942 edtn.) 599, fn. 16.

geographers would admit. If the Nilotic environment is "the positive factor to which the genesis of the Egyptiac civilization is due," then, says Toynbee, every other area with a similar environment should independently produce a similar civilization (58/I, 256). But this overlooks the fact that it is not possible to consider environment except in relation to that which it environs: always "the environment of people (or species) X" is implied, and X is a variable even if the environment is not, which in fact it is. For Toynbee's dictum to work it would be essential to construct a 'model' (in the economists' sense) in which all variables except physical setting are reduced to uniformities, and moreover the variations in the physical setting are themselves merely and strictly repetitive. Toynbee rarely gives much weight to location, which in itself of course rules out the identities he postulates. But even granting this impossible identity of terrain and climate, there are still the vitally important differences of location in relation to the movements of peoples at stages of culture capable of developing into civilizations, or in relation to the habitat of cultivable plants. These depend not only on current terrain and climate, but also on palaeogeographical changes.

It seems evident, also, that whatever the origins of the primary civilizations may have been, at a very early stage external contacts assumed an importance not sufficiently regarded in Toynbee's scheme of things.[1] But waiving this, and again granting that the various great rivers of Africa, Asia and North America provided virtually identical environments (which is not true), for each to develop independently its own civilization would seem to demand that all would have to start with peoples at the same stage of culture at the same time. Otherwise we must assume a degree of isolation for which archaeology offers no warrant, but rather the reverse. This simultaneity is obviously ridiculous, so that even were Toynbee's assertion that the Nilotic environment reappears in the Colorado true, the fact that no civilization appeared in the latter proves nothing: it might be merely a time-lag.[2]

There are several strands in this misunderstanding of the physical environment. Probably most important is an almost complete lack of the sense of scale, surely a prime requisite of geographical thought, and it must be repeated that in these contexts Toynbee is writing geography and nothing else. The equation of Nile and Jordan is a glaring example. Again, the Nile of prehistoric Egypt is equated ecologically with the Sudd to-day, a region of difficulty, and the Egyptiac civilization is said to have owed its start in life and its success to the heroism of its founders in plunging into this forbidding swamp and taming it, instead of docilely yielding to the challenge of desiccation

[1] Toynbee's tendency to an atomistic segregation of the field of history into self-contained and exclusive segments is criticized from the historical point of view by Collingwood (*loc. cit.*) and from the geographical by P. Gourou, "Civilisations et malchance géographique," *Annales-Économies Sociétés Civilisations*, 4 (1949) 445–50. But a final judgement should perhaps wait on the appearance of the unpublished section of 'A Study' entitled "Contacts between Civilizations in Space"; though the separate consideration of time contacts is symptomatic.

[2] This equation is so surprising that I quote the words of the abridgement (p. 58), which are practically the same as those of the original (I, 258): "the most captious critic cannot deny that the environmental conditions offered by Egypt and Mesopotamia are also offered by the valleys of the Rio Grande and the Colorado."

and migrating (68–73/I, 302–15). There is obviously a good deal in this, but is the emphasis on the severity of the challenge, one of Toynbee's leading motifs, really valid? Assuming that the ecological reconstruction is correct, the comparison of the valley bottom in Egypt with the swamps of the Bahr-el-Ghazal leaves out of the reckoning the all-important difference in scale between a strip of marsh 10 or 15 miles wide, which can actually be overlooked from the firm ground on either side (ground which provided settlement-sites with tool- and building-stone), and on the other hand vast swamps ten times as wide and with no compensating advantages. There is an obvious difference in tractability, not to mention the point already made about the river navigation, and later the accessibility of copper and other minerals lacking in the Sudan. This same instance also suggests the very limited way in which Toynbee regards the physical setting: he looks upon it as consisting of terrain, of climate, of vegetation, of soil, of a shape on the map. But in any given case only one or two of these factors is considered. The idea of the environment as an indivisible complex of all these factors, and more, hardly ever appears.

In general, Toynbee's attitude to environment seems two-faced. On the one hand it plays a considerable part in Challenge-and-Response, where the handling is at times brilliant and stimulating, *e.g.* in the discussions of new ground and of overseas migrations. In this last context Toynbee goes so far in the direction of determinism as to approve the formula "Drama . . . develops in the home country, Epic among migrating peoples" (106–7/II, 96). But on the other hand he seeks to minimize its role or to stand it on its head. "We have been led to reject the popular assumption that civilizations emerge where environments offer unusually easy conditions of life, and to advance an argument in favour of exactly the opposite view" (80/II, 1–3). Not quite exactly; for taken literally this argument holds the startling implication that ice-caps and sand-deserts should be the seats of civilizations. Toynbee therefore retreats, as well he might. After many pages we arrive at the hazardous conclusion that there can be too much of anything, and that the maximum of hardness is not the optimum. Does it really need all this analysis to reach this unimpressive truism?

Two or three further comments may be offered. No serious student of environment would accept the view that Toynbee tilts at: for once we may follow him in accepting an illustration from myth, and assert that no-one thinks civilization likely to arise in a Garden of Eden. In any case the words 'easy' and 'favourable' are not necessarily synonyms. Secondly, as Gourou points out, Toynbee's determinism is no less determinist for being a transposition of the "popular view": 'Le déterminisme des conditions défavorables au lieu du déterminisme des conditions favorables, est-ce un progrès?' Much of the misunderstanding seems to spring from the statement that the physical environment "taken by itself" cannot be "the positive factor which . . . started humanity on the hazardous quest of civilization" (59/I, 270–1). But then in the very nature of things environment cannot be "taken by itself" but only in relation to what it environs, in this case Man; a point to which we shall return. Further, why "the" positive factor? Does this not beg the question? For Toynbee the decisive thing is apparently the unpre-

dictable reaction of man to an ordeal; and this ordeal, in the crucial initial cases, is provided by a change in the environment. This unpredictable reaction we may grant; but then this unknowable human positive is not positive, but only potentially so, until it is matched with the environmental change, and we are back where we started. No ordeal, no reaction, and the problem resolves itself into the ancient one of the precedence of chickens and eggs.

The flaws evident in Toynbee's treatment of environment do not of course invalidate his entire argument, though they are somewhat disconcerting at this early stage of the book. 'A Study of History,' like most great systematizations, is not so monolithic as its author would like it to be. Most of the development of Toynbee's theme springs from different, largely psychological, bases; many of these may indeed be questioned, but they are not germane to this discussion. It is enough to suggest that on this important topic of environmentalism Toynbee's words are very far from being the last words; and in so far as his foundations are geographical, which is far indeed, they are undeniably shaky.

Huntington and History

Huntington's failings are numerous enough, and generally all too obvious. Science for him is emphatically quantitative knowledge, and almost anything can be measured if the right units can be found. So "intermediate peoples, such as the Chinese, occupy intermediate places, with more cars than the pygmies, less than the Bulgarians"; and the context makes it quite clear that this is a scale of advanced or retarded civilization (6–7). Sheldon's psycho-physiological theory is taken over and applied to the analysis of religions, with results which Huntington admits to be speculative; spectacular might be a better word. Post-mortems on "three groups of ten or more elderly Americans" provide the ratios of height, weight and length of bowel from which we may proceed to the view that the Buddhist ideal of contemplation "might almost be called a glorified version of the visceratonic propensity to sit still and enjoy a good smoke after dinner"; whereas in Christianity cerebrotonic self-restraint keeps the mild virtues of viscerato-nicity from going to seed, at the same time avoiding the aggressive and domineering qualities "which go with the mesomorphic body and the somatonic temperament" (46–51). Huntington has unfortunately to add that later Western Christianity has been more militantly somatonic; the implied compliment to earlier Eastern Christianity suggests that Huntington has not read his Gibbon: Conciliar history tells a different tale.

These, it must be admitted, are startling value-judgements, and it would be easy to compile an anthology of such excrescences. But the point is that they are excrescences, and can be excised without affecting the main arguments significantly. These arguments are indeed open to serious criticism, but on an altogether higher level. It is unfortunate that such excesses tend to obscure the very considerable amounts of solid observation and reasoning which underlie Huntington's major thesis, whether it is in the upshot tenable or not. Thus it is easy to point to the anomalies in the famous civilization-and-climate maps, though in our hearts most of us Westerners probably

believe that the facts are as stated. The basis of their construction is subjective enough, and the way in which the statistical aggregates are used gives a picture sometimes at variance with direct impression in the field, as, for example, in India. Again, if the maps are taken too literally, it is facile to assume that much is liable to be non-suited by technological change; the high ranking of Norway, for instance, would have been impossible a century ago, before Ibsen and hydro-electricity. Such objections are true enough, and it must be admitted that at times, as in 'The Human Habitat,' Huntington himself has given colour to them. Nevertheless they lose much of their point when we remember—what is too often forgotten—just how much Huntington claims. It is only fair to quote the limitations he himself lays down: "The map of climatic efficiency has sometimes been misinterpreted as the basis for a theory that climate is the 'cause' of civilization. This is a curious mistake. The map does not even indicate the existing efficiency in different parts of the world, for that is influenced also by heredity, stage of culture, diet, and other factors" (247). And in general Huntington insists on proper scientific caution, and on the role of cultural factors, to a greater extent than is often recognized.

Nevertheless, all allowances made, it remains true that his pattern is too much determined by physical factors, and gives too little play to the autonomous development of societies; development is indeed allowed for, but usually referred back to the environment. One reason at least for this lop-sidedness in Huntington is that he lacks what is at least as essential to the historian as is the sense of scale to the geographer, and that is sympathetic insight.

Before dealing with this major issue it should be noted that Huntington writes history at least as often as Toynbee writes geography, and here too a looseness of treatment is often noticeable. A good example, parallel to Toynbee's Withdrawal-and-Return of England, is the treatment of the Renaissance in 'Mainsprings' (599–607). Here it is an uncritical acceptance of secondary authority which does the damage; but this itself seems to arise from a desire to make the historical sequence match the sequence of weather. So we find Cheyney cited to the effect that the "dam" holding back social evolution burst in all Western Europe at "practically the same time"; that cultural imitation is not a satisfactory explanation, and that in any case "no testimony to such imitation exists." It certainly does, for example, in architecture, town-planning or the displacement of traditional verse-forms —alliterative metres, *redondilhas*, and so on—by the *dolce stile nuove* and the formal stanzas and sonnets, spreading from Italy to Portugal and Scotland, and later even to Sweden. In England we need only think of Chaucer's debt to Dante and Boccacio and Torrigiano's sculptures on Henry VII's tomb. However true (and it is abundantly true) Huntington's own dictum that "a rational understanding of history requires a good knowledge of the changing physical background," one cannot but agree with Hartshorne's rider: 'and a sound knowledge of the historical events.'

But the fundamental historical weakness in Huntington is not looseness of detail but lack of sympathy. This is linked with the insistence on a 'scientific detachment' in which the observer himself is unwittingly taken as the norm, though this affects all the conditions of the observation and so vitiates it.

There are hints that Huntington himself felt the inadequacy of his spiritual arithmetic: "Unfortunately no widespread statistics are available for such qualities as idealism, altruism, honesty, self-reliance, originality, and artistic appreciation." But this difficulty cannot be allowed to stand in the way: "In general, however, these seem to be best developed among people who excel in more readily measured qualities, such as literacy, education, the use of libraries, and gifts for philanthropic purposes" (233). People like ourselves, in fact; flattering, but doubtfully true, and fatal to real objectivity. To understand any movement of minds and wills one must so far as possible get inside it and feel it, though this process must be checked by a return to a more general external standpoint.[1] In retrospective thinking, failure to achieve this results in a thin empiric view of the contacts of great cultures, textbook stuff in which all that matters is who won, and in which the positive values which weave the rich texture of the past are at best resolved into clichés.

This essential quality of insight Toynbee often displays and Huntington signally lacks. The results are strikingly apparent in his discussion of geography and religion (281–306). Here we find a table ranking eight religions by latitude and by ethical content; the two orders are very similar. Christianity comes out on top, and one feels that only some lingering prudence inhibits a further latitudinal sub-division between Popery and Protestantism. We may sincerely believe in the primacy of Christian values; that said, how can we make a table of precedence for such complex and multiform faiths as Islam, Buddhism and Hinduism?

Huntington goes on to suggest correlations between various ideologies and their environments, including the old question of the relation between monotheism and the Afrasian arid lands (292–3). This, especially as regards Islam, is something of a test case, and may be examined in some detail. It must be said that Huntington shows more awareness of fundamental difficulties than Semple before him or Whittlesey after, and he faces not unreasonably the problem of free will. We must agree with him that "there is absolute determinism in one respect; the experiences of a walk through the jungle cannot be identical with those of a similar walk in the desert." But this is the merest truism, and the argument which follows is not much better than Buckle's appeal to the immensity and malignity of the Indian environment to explain the grotesque imagery of terror in Hindu mythology—forgetting its lavish imagery of grace and beauty. The argument presented is merely the converse of Buckle's: "out in the desert the things that man chiefly fears are big—winds, sun, cold, heat, drought" ;[2] and while "the desert man is as free as the jungle man to believe in spirits that inhabit stones, bushes, lizards, and beasts of prey, there is less incentive to do so." Why? One might think that an isolated rock or bush, vital as a landmark, is much more likely to be the

[1] 'Do you wish to understand the true history of a neolithic Ligurian or Sicilian? Try, if you can, to become a neolithic Ligurian or Sicilian in your mind. If you cannot do that, or do not care to, content yourself with describing and arranging in series the skulls, implements, and drawings which have been found belonging to these neolithic peoples. . . .' Croce, quoted in Collingwood, *op. cit.* 199.

[2] We are at least spared the clear skies and the glittering firmament on high which, in the cruder determinists, amply account for monotheism by reminding man of his own insignificance.

dwelling of some *genius loci* than a rock or bush lost amidst thousands of its fellows [1]; and the rarer the lizard, surely the more potently significant. To return to Huntington's argument, because of this bigness of things it is "natural for the primitive desert man to pin his faith to a few powerful gods who rule large areas. This does not compel him to believe in a single god, but it makes the transition to that belief easy and natural." But look at the facts, and especially the question-begging word "primitive." So far as is known the first approach to monotheism took place in the far from primitive society of Ikhnaton's Egypt. The Mosaic dispensation may have evolved in the desert, after contact with Egypt, but Jehovah triumphed over a plethora of local godlings in Palestine, a country small, articulated and not "big" in the sense implied by Huntington's description of the desert. How primitive was Hebraic society, in contact with Phoenicia and involved in the struggles of the great Empires of Egypt and Mesopotamia? Unfortunately it must also be admitted that there was plenty of animism in Arabia before Muhammed's time; and are we sure that there is none now?

One may perhaps agree with Huntington's summing up that "it would be false to say that belief in one universal God necessarily evolved in a desert, but it is true that the evolution of such a belief is more probable there than in the jungle"; but the questions just asked suggest that many vital considerations are omitted by this mechanistic psychology. The fact that the three great monotheisms all issued from south-west Asia certainly challenges explanation—explanation at least of the 'secondary causes,' not to prejudge the question of revelation. But, besides the fact that other religions contain monotheistic elements, it must be noted that the three are in a sense not three but one: Christ is the Judaic Messiah, Muhammad fulfils Moses and Jesus, Jews and Christians are also Peoples of the Book, and to the latter Islam was initially just another heresy. This of course still leaves the question: why the one? On this all that can be said with much assurance is that such environmental influence as there may be is not so likely to be a direct matter of psychology as an indirect one of societies with a strong emphasis on discipline and experience, rendering appropriate a conception of Deity as a greater patriarch. On the general question one may ask how, on environmental principles, one can possibly explain the co-existence of essentially atheistic philosophies, such as early Buddhism and some Hindu schools, with polytheism and pantheism under the same skies and within the bosom of the same social system? The patterns are far too involved for any simple key to be of much value.

Huntington, it is true, knew Asia at first hand, and avoids the simple correlation of Islam and nomadism exemplified by Whittlesey, who speaks of Islamic law as integrating tribal government 'throughout the whole broad and uniform zone' of the Afrasian arid lands; 'Evolved in the desert, Moslem law eminently suits the conditions found there. It provides for whatever degree of political unity strong chieftains may from time to time assume over the scattered tribes. . . . The Koran is both the Holy Book and a guiding star for Moslem society. As a political instrument it is a standing and familiar nega-

[1] In Burma, at least, animist cults are attached to particular species, or to particular trees, not to trees or jungle in general.

tion of the concept of government held by sedentary populations the world over.' [1] Aside from the assumption, perhaps more bold than wise, that sedentary populations the world over have one concept of government, the sentence about strong chieftains hardly covers the Caliphate, a Universal State founded in the seventh century which could still be a subject of agitation in India in 1921. Above all, from about 700 A.D. at latest the great majority of Muslims have been either sedentary agriculturalists, or urban traders as, indeed, was Muhammed himself.

Even in Huntington, the over-emphasis on the Afrasian arid environment, important as that is, ignores the fact that great faiths have their own life and growth. It would be strange indeed if a great movement of thought and feeling showed no powers of adaptation in a life of over a thousand years and in environments ranging from the Pyrenees to Yunnan, to Java, to Nigeria and to Mozambique. The great-uncle of Babur, the Mogul conqueror of India, 'evangelized' the Uzbeks, and tells us that he did not feel his task was complete until he had introduced cities and settled life; I think his authority equal to that of Semple, Huntington or Whittlesey. Then there are the rather difficult anomalies, on this narrow Islam-Nomad correlation, that the greatest Islamic state by population, Pakistan, is predominantly a society of settled cultivators. Probably the largest single blocks of Muslims in the world occupy environments as far removed from those of south-west Asia as could be imagined; the 30 to 40 million in Bengal, the 50 to 60 million in Indonesia. These anomalies, in Bengal at least, can be resolved without undue difficulty, by reference to the history; but this is what the sterner environmentalists rarely do, except in the loosest manner. There are without doubt links between environment and Islamic ideology; but they cannot be discovered simply by looking at Islam from outside, deciding (largely *a priori*, in accordance with a more general theory) what its principles should be on the basis of its assumed desert environment, and then regarding them as fixed for all time. This is a rigid materialism which far outgoes that of Marx, who allowed for at least some reflex action of the ideological superstructures on the economic driving-forces of history.

Here we are not dealing with mere excrescences, which could be amputated without much effect on the healthy functioning of the rest of the organism; these matters lie too central to the theme. If there were not more to be said, determinism would stand condemned. But there are reservations. It can hardly be denied that there are many sections of 'Mainsprings' and Huntington's other books where he makes out a strong case. The analyses of short-term weather cycles and their effects on human activity contain trivialities, misconceptions, injudicious use of statistics, and dubious assumptions. Yet there is much in them which cannot be lightly discounted, and they form important contributions to the direct psycho-physiological influence of climate; it may be too early to make valid generalizations, but not to examine data and to suggest hypotheses. Elsewhere the argument may not be logically flawless, and yet it may be difficult to refute the findings as a whole, as in the

[1] 'The Earth and the State,' p. 558. On the alleged uniformity of this zone, *cf.* K. de B. Codrington, "A geographical introduction to the history of Central Asia," *Geogr. J.* 104 (1944), reference at p. 28.

discussions of the Puritan element in American society (98–126), of Icelandic culture (127–48) and of the effects of migration (68–97). I would stress again that he is not so one-sided as is often assumed. It is true that the weight he attaches to heredity can be discounted since he here evolves a theory of group qualities and aptitudes originally largely moulded by physical, especially climatic, influences, and so refers back to environment at a remove. Nevertheless the reader who puts prejudice aside will find not only much acute observation but also much good judgement, giving due weight to ethnic mixture, cultural contact and acculturation.

One could cite many supporting passages, in particular perhaps the closing pages of 'Civilization and Climate' itself [1]:

> 'Even if our hypothesis be fully accepted, no less importance will thereby attach to the other great factors which condition the events of history. Because a man dies for lack of air, we do not think that air is more essential than food, drink, warmth, the circulation of the blood, the reproduction of the species. . . . So is it with history. Even if our climatic ideas are correct, it will still be true that the ordinary events of the historic record are due to the differing traits of races, the force of economic pressure, the ambition of kings, the intrigues of statesmen, the zeal of religion, the rise of men of genius, the evolution of new political and social institutions. . . . Yet a comprehension of the part played by the climatic factor will enable us to explain some of the events which have hitherto puzzled us. Not all will be thus explained. . . .'

And how pointless are Hanson's gibes, in 'New Worlds Emerging,' in the face of Huntington's explicit assertion that his climatic hypothesis holds out most hope for the tropics themselves. "If we can conquer climate, the whole world will become stronger and nobler"; these are the last words of 'Civilization and Climate,' naïvely put perhaps, but far indeed from the crude necessitarian label given to Huntington by critics some of whom do not even bother to spell his name correctly.

In the last resort he comes very close to Toynbee: "Means puts his finger on the crux of the problem when he says that in order to attain civilization people need not only a stimulating climate and raw materials well fitted to their work, but also 'an indefinable factor' which is 'apparently psychological' " (398).[2] Precisely the same passage is quoted by Toynbee (I, 273); to me at least Huntington's use of it seems more modest, more valid and more constructive. At his best Huntington gives us a large and noble vision of our earth as the link between Cosmos and the microcosmos, Man.

Towards a Synthesis?

So far I have examined, in what may seem an unduly critical spirit, two antithetic philosophies of history which have yet a common significant character in that they both seek to establish a pattern and so are broadly

[1] This lengthy extract is quoted by courtesy of Yale University Press.

[2] Characteristically he spoils this by a passing reference which implies that the Mongols in China, the Moguls in India and the Turks in Anatolia brought civilization to those countries.

determinist. Toynbee, on the whole at least, may seek to minimize, Huntington to stress, physical factors; yet even here they are but two sides of the same coin. The link between them I think is this: that however much they differ as to the role of environment, they both fall into the fallacy that there is or can be such a thing as environment "taken by itself." Nor are they alone in this; Mackinder says that 'human society is still related to the facts of geography, not as they are, but in no small measure as they are approached in the course of history.'[1] But the facts of geography are the facts as they are approached; there is no other geographical way of looking at them. This does not for one moment deny the objective existence of the world altogether apart from man. Before man was,

> the hills in order stood
> And earth received her frame,

and his exit from the stage may not be a very important incident in the cosmic drama. But this world without man is not environment, is not our world. The earth abstracted from man is a proper object of study—of the studies geology, geodesy, seismology, geomorphology and so on. These have the most intimate relations with geography; there should be no question of 'taking the ge out of geography.' But at least since Humboldt, if not Strabo, geographers have looked on earth not simply as a physical body but also as the home of man.

The frame of earth, then, is not in itself environment. It was there before man was, but then it was not human environment, because there was nothing human to environ. "Environment taken by itself" is a meaningless phrase; without man environment does not exist.[2] But we are fully entitled to make abstracts or isolates of the physical factors for study; it is obviously essential to do so. The danger is in setting up a false duality and so involving ourselves in insoluble or unnecessary questions of the chicken-and-egg order. There is also the danger, shared by possibilist and determinist alike, of anthropomorphizing Nature; those who talk glibly of 'cooperation with Nature's plan' do not often face up to the teleological implications of this phrase.[3]

Insistence that there is no human environment without man is not in itself incompatible with the strictest determinism of physical controls. It is not necessary to demonstrate formally the error of that view; it is patent in our examination so far, and indeed the tide of geographical opinion is still running strongly against it. Perhaps too strongly, since it does not seem certain that 'possibilism' as often understood (or misunderstood) is the automatic alternative to a rigorous environmentalism. There may be a middle term, which one might call 'probablism'; nor do I think that more than this is really implied by the original French masters, Vidal de la Blache and the rest. It

[1] 'Democratic Ideals and Reality,' Pelican ed., p. 30.

[2] Always, of course, humanly speaking; but one might try 'Principles of Piscine Geography,' which would presumably begin by the statement that two-fifths of the earth's surface was inaccessible and unfitted to support the higher forms of life. This fancy illustrates quite seriously the fallacy of thinking of environment apart from the environed, instead of 'environment for what?'

[3] *Cf.* the conclusion of G. Tatham, "Environmentalism and Possibilism," in G. Taylor (ed.), 'Geography in the Twentieth Century,' pp. 128–62.

must be remembered that they worked in an atmosphere steeped in precise methodological thought; English empiricism and American pragmatism may sometimes miss its undertones.[1]

Let us take Febvre's famous assertion 'there are no necessities but everywhere possibilities.' I agree with what I take to be the meaning of this sentence; yet there are times when I feel that no single dictum has had a more disastrous influence on modern geographical thought and work. There could be no confusion if Febvre had added 'of which some are more possible than others'; probabilities, that is, rather than a vague assortment of free choices. Febvre himself mentions the negative necessity of not trying to grow pineapples in Greenland, and the much more important matter of commitment by one's choice: 'all possibilities are not compossibilities.' Clearly he did not mean to say that any possibility is present anywhere at any time, and Tatham is right in pointing out that sniping at possibilism on the pineapples-in-Greenland line is futile. Put so bluntly this is a truism; but in practice the emphasis on human initiative, correct in itself, has sometimes been given its head and has landed in thinking which is as intolerably woolly and vague as rigorous environmentalism is intolerably narrow and crude.

The repudiation of 'influence' in favour of 'relation' also carries with it the risk of a tendency to merely empirical description; this is perhaps a special risk attaching to the view of historical geography as simply 'the reconstruction of past human geographies.' This conception was a justifiable reaction against the view of historical geography as simply 'The Map of Europe by Treaty,' past geostrategics, and perhaps a glance at trade-routes added. It has meant a great deepening and enriching of the actual content of the geography of the past. But at times also it has meant no more than economic history plus maps; by no means a valueless thing, but often overlooking political sequences and distributions which are themselves an integral part of the past geography, at once affecting and affected by the physical and economic geography of the times. A case in point is J. N. L. Baker's scholarly essay on the seventeenth century in 'An Historical Geography of England to 1800,' an essay containing much admirable reconstruction. But nobody reading it would suspect that the century saw a civil war whose issue vitally affected our way of life, our very being as citizens of a constitutional monarchy. Nor can it well be maintained that this is 'not geography'; the distribution of allegiance is a geographical matter if ever there was one. Apart from the obvious significance of the Parliamentarian leanings of the ports and clothing towns, is there not a challenge to geographical inquiry in the fact that the very areas which supported the Crown (the North, the West, and Wales) were those which had most opposed the Crown of a century before—the century of the centralizing Tudor monarchy? To write anything on the English seventeenth century with the word 'historical' in the title and to say nothing of the Civil War[2] is simply to write Hamlet without the Prince. I do not think that Hartshorne has said the last word on this topic, though

[1] Tatham's essay just cited, although avowedly leaning to the antideterminist side, does seem to indicate at least some recession from the full possibilist position.

[2] In fact these words occur twice—in the diagram, Fig. 65, where they are left in the air, entirely unexplained, and a casual reference to the destruction of timber.

he himself seems to think so, when he claims that the question of the nature of historical geography is closed in favour of 'simply the geography of past periods'; [1] unless indeed this phrase includes such political matters as those just mentioned, which seems far from Hartshorne's intent.

At bottom the extreme trend away from environmentalism seems to have an odd psychological motivation, a feeling that determinism means philosophical materialism, which is not necessarily so, and that it is thus disreputable or even immoral, which is even less so. To speak of 'controls' is doubtless nearly always illegitimate, but not, I think, quite always. This fear of controls seems to lead to a horror of admitting quite reasonable 'influences.' One almost suspects a kind of terrorism of what the French might say; but what if French possibilism were itself geographically determined? It would not be difficult to work out a plausible case, beginning with the Franco-German antagonism after 1870 and the obvious element of reaction against the suspected ulterior motives of Ratzelian political geography; and for that too there are excellent reasons along the lines of old-style historical geography.

This 'flight from controls' and yearning for a geographical free market are excellently illustrated in Gauld's 'Man, Nature, and Time,' in many ways an admirable book, one of the few which can be recommended to the intelligent student who wants a brief synthetic statement of what modern geography is about. Yet its acute *aperçus* are often left hanging in the air through failure to relate their data to the physical setting from which they cannot really be detached. One or two instances must suffice. Of the Eskimos we read: 'What is striking is that so far from the elementary primitive economy which so severe an environment might suggest "they make use of the most elaborate devices known among primitive men, and their implements show amazing resourcefulness and ingenuity".' [2] Apart from the confused identification of the economy, which is primitive and elementary enough, with technique, it is surely precisely because the environment is so severe that the adjustment has to be intricate and ingenious. It would indeed be striking if the Eskimo managed to survive without elaborate skills and devices.

More important, and indeed something of a test-case for possibilism, as Islam is for determinism, is the question raised by Gauld in these terms: 'we might argue that a plantation economy based on slavery had much more to do with cotton-growing in the United States than any particular group of physical conditions.' [3] This claim merely shifts the problem one stage backwards; it is justified as a protest against a direct determinism of 200 frost-free days automatically producing cotton-growing—if anyone but examinees ever thought on those lines; but as an explanation of the distributions it raises or begs more questions than it solves. Why did this plantation economy fix where it did, and not in New England or New York; or even near at hand in the Appalachians? Factors of social tradition—the aristocratic origins of the great grantees against the yeoman, trading or artisan stocks of New England—play their part, and an important one; but no less important, surely, is the actual physical differentiation. On the one hand, in the Appalachians small-scale subsistence farming was at least favoured by the dissection and general

[1] 'The Nature of Geography,' p. 185.
[2] P. 144. [3] P. 26.

isolation of the country; one might compare it with the dispersed settlement of highland Britain. On the other hand, in the tide-water counties, terrain—and water transport—favoured production of bulk cash crops. To get the best returns from such quasi-monopolies as tobacco and cotton, on rapidly expanding markets, large-scale working was clearly indicated. At this point the social factors enter decisively; given the social climate of the times, plantations and the rest follow. But these social factors after all operate only within given, if sometimes elastic, physical limits. To ascribe the dominant and initiatory role to plantation economy as such, is to mistake contingent effect for cause. There is no merely social answer to the question: why a plantation economy in the tide-water and not the upland?

We may go further by comparing the series of voting maps in the 'Atlas of the Historical Geography of the United States' with a series of physical maps of the South. I think that no reasonably unprejudiced person could deny that the political and physical distributions correlate so closely, that it would require an impossibly high-wrought dialectic to escape the admission of a very strong influence one way or the other, by men or by mountains; and men did not make the Appalachians. Look at the great wedge of Republican votes, decade after decade, for President, for Congress, or in House divisions, breaking into the Democratic Solid South, and with very little variation in the marginal counties—just enough indeed to make a frontier zone rather than a boundary. Then think of all that goes with it; First Families of Virginia against poor Scots-Irish or Kentucky hillbillies; tide-water plantations against stony upland farms; slavery producing export staples against almost self-sufficient free labour; a tension of hill against plain culminating in actual secession when West Virginia cut loose from the Old Dominion to stand by the Union in the Civil War. It is of no avail to appeal to social origins as themselves an efficient cause of the distributions, since we then have simply to move backward to explain the distribution of men of various social habits, a distribution too closely correlated with terrain to be mere chance. Admitted that the Scots-Irish had not the Court influence to get great estates nor the capital to work them if they had, we have the converse that the grantees pre-empted the plains counties and, when they did secure title to large upland tracts, had too much sense to work them plantation-wise, but turned themselves into companies for the sale of land to free settlers, as for example did George Washington.

Here possibilism simply will not do; I think even 'control' is not too strong a word, not in the sense that the environment enforces an agrarian economy, but that if for historical reasons an agrarian economy is introduced, then some such differentiation as took place follows. This is one single case and certainly does not prove a general physical causation; but if it is granted, which I think cannot well be refused, then it establishes at least the possibility in other cases. I do not think, therefore, that the question of environmentalism is as yet finally closed, or is ever likely to be, except in the obvious sense that environment is not the answer to everything. This discovery should not blind us to the fact that in some ways and places it may still be a useful guide.

The upshot seems to be that neither environmentalism nor possibilism is adequate without large qualification. As regards environmentalism, two

things must be borne in mind: first, the appeal to geographical influences is safest by way of social structures. The direct psycho-physiological effects of climate on individuals after all work themselves out through social life, and in so far as there is an environmental influence on thinking, it is largely subsumed in antecedent tradition, which is a social matter. It is not only, though largely, because of different material features of the environment that the metaphors of erotic verse are likely to differ between, say, a young left-wing intellectual at Cambridge and a Gond in central India. Neglect of this principle led to many of the rasher and grosser exaggerations of the Semple school, forgetful of the fact that the psychology of the individual is modified when he is part of a group. Secondly, it is, as Febvre says, the idea formed of the environment which matters as much as the brute fact: the facts are as approached. Failure to allow for this leads directly to the major fallacy of projecting backwards present knowledge.

But the approach to the facts can never entirely escape the actual facts; this is the qualification of possibilism, at least as too often presented. The point may be illustrated by a passage from Collingwood. I do not know if he ever read Febvre, but all historical geographers will recall a remarkable parallel in the latter's discussion of this identical theme: [1]

> 'The fact that certain people live on an island has in itself no effect on their history; what has an effect is how they conceive of their insular position; whether for example they regard the sea as a barrier or as a highway for traffic. Had it been otherwise their insular position, being a constant fact, would have produced a constant effect on their historical life; whereas it will produce one effect if they have not mastered the art of navigation . . . a fourth if everyone uses aeroplanes. In itself, it is merely raw material for historical activity, and the character or historical life depends upon how it is used.'

This I think is overstated. It has its truth: a raw material is only a raw material if it is used, and it may be used in one way or another, or not used at all. Nevertheless if it is not there, it cannot be used at all; there is a material datum to which the concept refers (it may be erroneously). The people cannot conceive of their insular position in any way unless they live on an island. In any event, whether the sea is barrier or highway it enforces special adjustments. Febvre also proves a little too much: 'England remains an island' not only as a matter of psychology, but also as a matter of logistics—the logistic problem provided by a 21-mile wide anti-tank ditch for which we have had cause to be grateful since Febvre wrote, and unfortunately may again. The use, of course, is largely a matter of social environment; but indirectly through society and technology there is an 'influence,' the challenge or stimulus of the object as well as of the subjective concept.

If the arguments here put forward have any validity—admittedly they are very much matters of debate—we may find ourselves left with a considerable residue of determinism. Because Huntington set himself too high an aim it does not follow that all his work is vitiated by his failure to explain all that he wishes to explain. A new statement of determinism, more moderate, more

[1] *Op. cit.* 200; *cf.* L. Febvre, 'A Geographical Introduction to History,' p. 225.

supple, and more subtle than the old, is badly needed, even from the standpoint of the convinced possibilist. Our study in its modern form is still so young, and deals with so wide a range of phenomena, that it seems likely that an empirical approach is still necessary.

This paper has been in some sort a plea for the integration of history and geography, and, essentially, an attempted integration forms a large part of the work of the two authors mainly considered. It is true, as Hartshorne says, that this integration would be the portrait of reality, and that we can never attain it; but this is no more than the inescapable limitation of all human effort to interpret fully the world or any aspect of it; always there remains

> One thought, one grace, one wonder at the least
> Which into words no virtue can digest.

Hence selection, limitation, difference of emphasis, construction of isolates, are all necessary. But it is as well that now and then the effort to transcend particularisms should be made, and this, in their differing ways, Toynbee and Huntington try to do. There can be little doubt that some residuum of their thought will be absorbed into the commonplace of historiography; and, despite Toynbee's greater brilliance of writing and of historical insight, it might be that Huntington's influence will be the more lasting, at least the more concrete and definable. This does not depend entirely upon literary quality; probably few geographers now read Humboldt, but fewer doubt his significance in the growth of our study.

The approaches of the two may be loosely, but perhaps not inaccurately, summarized as aesthetic in Toynbee, scientific in Huntington. I think that properly considered these are not mere opposites; like our authors, they interpenetrate. There is no art which has not its scientific element, be it only in technique; nor is technique alone adequate to the scientist if he is to attain his full stature. There must be an element of intuition, itself subject to the scientific analysis of psychology and not thereby devalued, any more than the beauty of a landscape is devalued by an understanding of the earth-processes which have moulded it. Perhaps the final limitation is that Toynbee broods too exclusively on Myth: Huntington on Statistic; but these are themselves but parts of Poetry and Science, which together make our vision of reality. Their apprehension as a unity is not yet, if indeed Man ever attains it.

DISCUSSION

Afternoon Meeting, 13 November 1950

Before the paper the CHAIRMAN (Professor L. DUDLEY STAMP) said: This Society is old enough to have seen many changes in the geographical world, and the Society's meetings have been the occasion for certain epoch-making conceptions of geography being put before the world at large for the first time. The whole concept of natural regions of the world which we associate with the name of Herbertson came before the Royal Geographical Society in the first place, and it of necessity follows that from time to time there is a need to take stock.

Dr. Spate is no stranger to this Society. We associate him with some of his

earlier work in historical geography at Cambridge, or with his later interests resulting from his experience in the University of Rangoon, and in India with his studies of Pakistan. This afternoon he is concerned with a broader field.

Dr. Spate then read his paper

Professor E. G. R. TAYLOR: As the first speaker it falls to my lot to congratulate Dr. Spate on his paper and to regret the more that some foreign potentate has been over here and is going to whisk him off into another part of the world.

There are only two slight remarks I can make now because one cannot discuss such a paper impromptu. May I remind you that much faulty thinking on the part of historians, philosophers and others is due to the fact that they always will set man against nature as if they were two distinct categories, Man *versus* Nature, instead of man and his environment being regarded as a single complex. Dr. Spate used the word "altogetherness" and then he criticized Professor Toynbee for making the mistake of the analogy between the Jordan and the Nile. But no historian does more than "glance at a map"—that is the historians' favourite phrase.

My own memory as to determinism goes back forty-five or more years. When we were at Oxford as young people we were thrilled with the idea that there was a pattern anywhere, so we were enthusiasts for determinism. That is one of the words which have emotional overtones. And then we found that we angered the historians because determinism was mixed up with religious matters, the problem of free will and the opposite of it, so that some of us scuttled away behind that wishy-washey term "possibleness." Then all was quiet for a while because we made no progress. Unfortunately, determinism has come up again and it is not religion now; you are not irreligious if you talk about determinism; you are something much more dangerous: you are likely to be called a Marxist or a fellow-traveller!

It is going to be difficult to follow up Dr. Spate's suggestion and look into this matter a little more closely. Bertrand Russell has made a good suggestion, namely, that for names or words which have these strong emotional overtones we should substitute in our arguments the letters of the alphabet.

And now a word or two to the young oncoming people. In regard to the question of geographical causation, taking a rather narrower view than has been taken so far this afternoon, you probably know what happens if you suggest, for example, that there is a connection between geography and history. I remember an eminent industrialist saying: "Of course I know you cannot launch ships if there is no water and you cannot fly without having something on which to land again, but I do not see where else geography comes into it at all." And there is the person who absolutely clinches your argument by referring you to the coalfields. I advise any young economic geographer to read the modern historians. Let them read the current number of the *Economic History Review* and there they will find a careful analysis of how, despite the free human spirit, the shipbuilding industry did migrate away from the Thames.

Professor W. G. EAST: I think you will agree that it is most fortunate that we have had this meeting, and although perhaps I am exaggerating when I say it is an epoch-making session of the Royal Geographical Society, I think we shall come to think of it as such when we ponder over the highly suggestive discourse to which we have listened.

We tend as geographers in reading, writing and teaching to range the whole world, making our subject appear almost hopelessly extensive when at times we have a very tentative approach to it. Looking at it in relation to the history of

the time, which is one general theme behind the paper, I was impressed in particular by the very moderate and judicious way in which Dr. Spate criticized these two eminent men. We will all agree that Toynbee's geography was bad, and that Huntington simply did not have the real touch or the knowledge he should have had in handling his theme of historical pattern. And the historical pattern, of course, starts a line of thought on which I dare not enter now. In Toynbee the convention of the historian did not exist at all, because the historian has to be careful that the pattern which he creates does square with all that is known of the relevant facts. That is where Toynbee breaks down, because he sometimes appears to ignore some most important and relevant facts. Nevertheless I think you would agree that both Huntington and Toynbee provide the most valuable texts that any student of geography could read; he should read them for the excitement that their books convey and, it is to be hoped, for the critical reaction that they produce. So that in drawing attention to their shortcomings I am quite sure Dr. Spate is not in any sense detracting from their real value.

In the latter part of Dr. Spate's address he used what I believe to be a new word "probableism"; a somewhat ugly word. Looking back on my past I wonder if I was included in his strictures towards the end of his lecture. At any rate, if so I think I come out all right. When I look back, I discover that I said firmly of the Bavarian alps that it was impossible to cross them with an army coming from Bohemia towards the Danube. And so it was at that time. It is not so now. I was quite right to be emphatically determinist in that particular instance. In so far as one is concerned with the human element of any countryside, it is only men who can determine it, because nothing which is of the human order can spring out of Nature except by man's determination. But the freedom with which he will determine what he wills for a particular area is made possible or probable by the particular environmental facts.

Mr. G. R. CRONE: Dr. Spate has certainly given us much to think about. As Professor Taylor has emphasized, historians have frequently shown little knowledge of geography, but to counterbalance this, we have heard this afternoon of the errors in history committed by geographers. Looking back at the development of modern geographical thought, particularly to Karl Ritter and his school, one cannot help feeling that the influence of history upon geography has not been altogether happy. This question of determinism was introduced by the historians at the beginning, when geographical knowledge was insufficiently advanced to afford a sound basis for generalization. While the collection and interpretation of geographical material has made great strides, historians like Toynbee have not kept abreast of it. Do we even now know sufficient to indulge in these sweeping generalizations?

Dr. P. R. CROWE (Queen Mary College): It seems to me, in the first place, that we are trying to do something which is virtually impossible. We have to keep that clearly in our minds in order to understand the work of either of these men. I think Spengler is greater than both of them, although probably a little more wrong than either of them. They are trying to look at a culture in full perspective; to get outside themselves; outside their own human and geographical environment. I consider Spengler superior to either Huntington or Toynbee because he states very clearly indeed that it is extremely difficult, but ignores the fact that he is trying to do it himself. He does emphasize how one cannot even begin to appreciate cultural values if they are values of another culture.

I find myself in a difficult position about the two men who have been pilloried this afternoon. The works of Toynbee I have read; the works of Huntington

I have mostly found unreadable. Asking myself why that is so, it seems we have had an explanation partly by Dr. Spate and partly by a later speaker. Dr. Toynbee makes the poetic approach and, not being a poet, the poetic approach appeals to me and I enjoyed Toynbee. I found him stimulating and I think some of his comments are a definite step forward.

Huntington attempts to be a scientist, to tackle the problem statistically, and what rather annoys me is that he deals with statistical matters not too fairly. What is this probableism? I cannot think it is a great advance upon possibilism. I listened to the argument about island sites particularly carefully and it seems that the possibilism can be probableism. Admittedly that was not carried out in any great detail in the analysis.

The CHAIRMAN: I would like to draw attention to two particular points. It was brought out again and again from Dr. Spate's analysis how both the great men suffered because of the lack of sympathetic understanding of the other person's point of view. I feel that many of us have worked within rather narrow spheres and have failed to try to put ourselves into the other man's shoes and to see things from his standpoint. Secondly, it is noticeable how both men fell into error through the use of secondary sources. Instead of going back to primary sources they used secondary material, like a student who comes and says he saw it in such-and-such an encyclopaedia. That is dangerous.

I was a little shocked, Dr. Spate, when you fell into the same error yourself a little later by quoting a recent book, of which I think parts should be banned—'New Worlds Emerging' by Earl Parker Hanson. Because of the sympathy we want from both points of view, I hope there are historians present who will state their own, and we shall welcome contributions from them as well as from geographers.

Mr. R. BOWEN: It is easy to criticize Toynbee's work in detail, but in my view it does not matter if you criticize all his work; his general law still remains true. We all know that there are laws governing life and behaviour of human beings in this world; we know there is not one human being who made all those laws, yet the laws are still there. We also know that there are exceptions to that. In the same way Dr. Toynbee has tried to discover the laws and behaviour of civilization. The fact that examples he quotes can often be shown to be more or less wrong does not matter, because one can often sit down and quote out of one's memory other things which Dr. Toynbee has not mentioned but which fulfil to-day the laws he has enunciated. It seems to me that that is rather important.

Professor G. MANLEY: I should like to make a suggestion. It is that we as geographers do appreciate both Toynbee and Huntington inasmuch as we are always prepared to agree that facts are better than no facts, and that we can thoroughly appreciate the effort on the part of two exceptionally accomplished authors to put together a vast amount of material, both in space and time, in such a way as to make an adequate picture. Yet, on the other hand, I can also agree with Dr. Crowe's view that there is a great deal to be said now that we have a rough picture, even though it may be faulty. We want to pay more attention to rates of change and do more field work.

I believe most of us were brought up on Huntington's doctrine that we get an enormous stimulation from the fact that about 80 B.C. there was a heavy rainfall throughout Europe and a lot of people started invading Greece. Now the rainfall is put at 500 B.C., when I do not think there were any invasions of Greece at all. It seems to me that while the generalized picture may be reasonable, there is an extraordinary amount of detail which would be needed before we can produce the generalization. There is another point of view: one is

contemplating something which is not inherent in modern thought. We have gone through what I should describe as the Spengler epoch, in which the course of human history was represented as a series of waves; the waves increased in force and the big one came at the end and down went your civilization, inevitably doomed. Toynbee, on the other hand, makes a picture which is much more like the ebb and flow of a stream: there are a large number of elements in the stream which are bobbing up and down, and there are some civilizations which are also bobbing about very happily. Toynbee has done a phenomenally difficult job in that he has tried to map the course of the evidence which determined the stream.

The CHAIRMAN: If no one else wishes to speak I must say that it seems that Dr. Spate has been let off very lightly with the number of questions which he has had to answer. Therefore I wind up by asking one or two myself.

Do you, Dr. Spate, find evidence of evolution in the work of the two authors you have quoted? I do not know my Toynbee sufficiently well to be sure how far one can trace evolution of thought there, but it brings me back to a view of my own: I always wish there was some way in the scientific world of retracting what one has said in the past.

I had hoped that some speaker would have quarrelled with Dr. Spate over his curious concept of environment, suggesting that environment did not exist apart from man, who was the environment. Surely if you like to substitute the word "habitat," which is what we mean by environment, the habitat is there whether being used by human beings or not. Surely there is a habitat for man environmentally and a habitat for all the other animals. If you kill off all the men, the animals' habitat is still there to be considered by geographers—not, as Dr. Spate suggested, in little bits, but as a whole. I hope you will not insist upon that position, which to me is a somewhat curious one.

Dr. SPATE: I should like, first, to thank Professor Taylor for her remarks, and also Professor East. As for yourself, Mr. Chairman, let me assure you that in mentioning Hanson's book I made a repudiatory note.

I do not think there is very much trace of evolution in the works of the two authors. With the possible exception of the summing-up in 'Mainsprings' of the earlier work by Huntington, there is little on these lines in him: the central idea is adumbrated at best as early as 'The Pulse of Asia' (1907). I do not know the earlier Toynbee very well, but 'A Study' shows little sign of any development or serious change in Toynbee's position. I fear that in the question of environment or habitat I did not make myself clear. I agree about the objective existence of those things which make up environment, but until there is something in it it is not in itself environment; it is made up to environment when the things are there.

It is true that although many of Toynbee's geographical details may be wrong, this fact does not necessarily invalidate a good deal of his general theory, which is based upon independent premises. But those premises themselves are often questionable. I would further say that Toynbee's concept of scientific methodology is more than a little dubious. Undoubtedly some of the concepts of Toynbee are useful to the geographer. The way in which he deals with the concept of old and new ground is enormously stimulating and generally accurate, and even when not accurate the idea can be used again in another context.

Dr. Crowe confessed to an admiration for Spengler. If one takes literally the idea that we cannot possibly understand anything more than the mere shell or outside of other cultures, I think that is a gross over-statement. And how did Spengler know that there was more to other cultures than he knew?

THE VOYAGE OF *DISCOVERY II*, 1950–51

H. F. P. HERDMAN

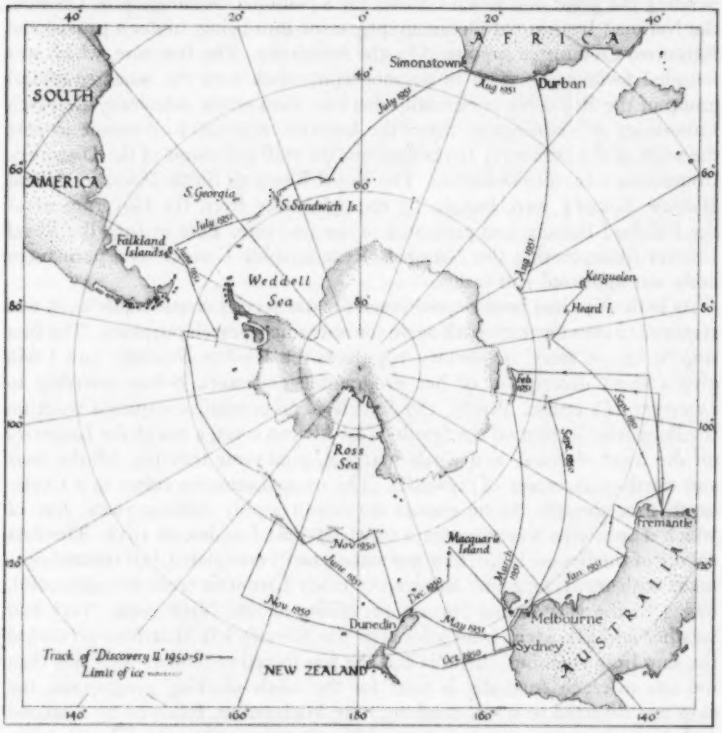
BEFORE THE WAR, several papers on the work carried out by the Discovery Committee in the Southern Ocean were read before the Society. In 1949, pending the grant of a Royal Charter for a National Oceanographic Council, the National Institute of Oceanography came into being, under a provisional Executive Committee appointed by the Admiralty. The Institute, which was founded to do basic work in oceanography, took over the oceanographical group of the Royal Naval Scientific Service, then at the Admiralty Research Laboratory at Teddington. Since the Institute was also to continue in part the work of the Discovery Investigations, the staff and assets of the Discovery Committee were also absorbed. The Royal Research Ships *Discovery II* and *William Scoresby* were bought by the Admiralty from the Government of the Falkland Islands, and presented to the Institute. Late in 1950 the Royal Charter incorporating the National Oceanographic Council as a permanent body was approved and sealed.

As both ships had been requisitioned for war service considerable work was required to convert them back again for scientific research purposes. The first ship to be got away, in January 1950, was the *William Scoresby*, and I will give a short description of her programme and work before referring to *Discovery II's* cruise. Briefly, the *Scoresby's* programme comprised work on the Benguela Current off the South-West African coast, a search for *Latimeria* off the coast of Natal, and whale-marking, plus some trawling, off the west and north-west coasts of Australia. The name Latimeria refers to a Coelacanth fish, thought to be extinct for about eighty million years, but of which a specimen was taken in a trawl off East London in 1938. The first survey of the Benguela Current was satisfactorily completed, but the attempts made with trawl, long-line and trap to catch Latimeria were not successful, owing to the very strong current prevailing off the Natal coast. Very bad weather and persistent head gales after the *Scoresby* left Mauritius prevented the ship from reaching Australia and she was forced to return. As it was then too late to reach Australia in time for the whale-marking programme, the ship was diverted to whale-marking near Madagascar, followed by a second and even more successful survey of the Benguela Current. The *Scoresby* returned to England in November 1950. Some very interesting preliminary results about the Benguela Survey are available, and among these is the discovery of a possible breeding ground of the pilchard, now an important fish to South African industry. Preliminary notes on this subject were published last year in *Nature*, by Hart and Marshall.[1]

But my main topic is the recent voyage of the *Discovery II*, a voyage which was planned to fill in a number of gaps in our pre-war observations in the Southern Ocean. For some years before the last war one of our main objectives had been the completion of an oceanographical survey of this

[1] *Nature* 168 (1951) 272.

Ocean, but our winter data were far from complete. It was for this reason that our programme for the Sixth Commission (our first post-war one) had been drawn up by Dr. Mackintosh to include work at sea during two winter seasons. Circumstances beyond our control caused a modification of the original scheme for the winter work, but so much remained to be done at that time of year that we had little difficulty in arranging an alternative plan. Eventually, the Indian Ocean Sector was visited in winter and summer, the Australian Sector in autumn and winter and the Pacific Sector in spring and



winter. In the Atlantic a cruise was made across this sector in winter only. Much of the winter work was included in a circumpolar cruise made during the winter of 1951, between the months of May and September. This is only the second time in history that a winter circumpolar cruise has been made in Antarctic waters, and each time it has been made by *Discovery II*. The earlier cruise was completed in 1932, but as that voyage started in a different part of the Southern Ocean the various sectors were visited at a slightly different time of year, and the results do not overlap those now obtained.

The fact that the Southern Ocean is a continuous belt of deep water surrounding the Antarctic Continent simplifies the system of ocean currents, and

the circulation of the water masses. This relative simplicity of the water conditions makes it easier to study the large-scale physical, chemical and biological processes of marine life. It also allows us to make generalizations from fewer data than would be possible in other oceans. Another factor which tends towards the simplification of physical conditions in the Southern Ocean is the relative freedom with which movement of the water masses can take place between this continuous belt of deep water and the oceans to the north of it. There is, in fact, a definite and reasonably simple pattern discernible in the exchange of water at all depths between the Southern Ocean and the oceans to the north. One example of this is the Antarctic Convergence, which is the well-marked boundary, in the surface layers, between Antarctic and Sub-Antarctic waters. Farther north the sub-tropical convergence marks the boundary between the Sub-Antarctic and sub-tropical zones. During this last commission the possession of a bathythermograph made it possible, at least on one occasion, for us to examine the Antarctic Convergence in detail.

Discovery II finally sailed from Plymouth on 10 May 1950. South and south-east of Malta we carried out a special series of seismic and echo soundings in connection with a gravity survey of the eastern part of the Mediterranean being undertaken by Cambridge University. Our share of the seismic work comprised the recording of echoes returned from the bottom and sub-bottom strata, following the propagation of soundwaves by the explosion of a small charge just below the surface of the sea. Continuous echo-sounding records were taken as necessary on our course, which was largely over unsounded areas of the bottom. We then proceeded to try out the Kullenberg piston bottom corer, which we were carrying in a shortened form. Dr. Kullenberg himself was with us at this stage of the voyage, and with his unparalleled experience we were able to evolve a technique for handling the gear.

Observations on the interchange of water between the Red Sea and the Gulf of Aden were made immediately after leaving the Red Sea and we reached Colombo on June 15, after a rough passage in monsoon weather, across the Arabian Sea. The weather had improved slightly when we left Ceylon several days later, but on the important line of deep oceanographical stations south on the meridian of 90° E., in the little-known Central Indian Ocean, we were much hampered by bad weather. Winds were strong and headed us for some days, but a reasonably good series of observations was obtained between the equator and lat. 30° S. It was during this same wintry period that the *Scoresby* found herself unable to make headway eastwards from Mauritius.

On the completion of this line we turned east for Fremantle, where we arrived on July 6. It had been intended to go out again almost at once to continue the line of stations in 90° E. to the ice edge, but unfortunately certain engine defects had developed on the run in to Australia, and we were delayed for some weeks while repairs were effected. The 90° line was eventually completed in August, in very bad weather, and after a month at sea we returned to Melbourne. Little or no work was possible on this run up from the ice, because of persistent westerly gales. In fact, during the whole cruise, the wind force was between 6 and 11 on the Beaufort Scale on all but three

days. Pre-war experience of working stations near the ice in this month had shown that bad weather would probably be the rule, but conditions in August 1950 surpassed even those of August 1938! Nevertheless, we were able to work sufficient stations on the 90° E. line to give valuable information as to winter conditions here.

Few oceanographical observations, other than surface or near-surface ones, have been made in the Central Indian Ocean at any time of year, and it had been hoped that during this last commission it would be possible to do winter and spring lines on 90° E. over the whole distance between the ice edge and the equator. Also we had intended to make a set of summer observations over the southern part of the line. Most of this programme was completed, and preliminary comparisons with the well-known conditions prevailing north from the ice-edge in the Atlantic, and those of the Pacific Sector, show that the system of water circulation in the Indian Ocean is probably very similar —at any rate in its southern and south-central areas.

Since the Governments of Australia and New Zealand are among those who contribute towards the finances of the National Oceanographic Council, cooperation in the examination of some of their off-shore oceanographical problems has occupied a certain amount of our time when the ship has been in Australian or New Zealand waters. Thus, after leaving Melbourne in September 1950, we worked some lines of off-shore deep oceanographical stations for the Fisheries Research Division of the Commonwealth Scientific and Industrial Research Organization—more familiarly known as C.S.I.R.O. We reached Sydney a week later, where we were able to visit the laboratory and headquarters of the Fisheries Research Division at Cronulla. From Sydney we went eastwards, in mixed weather, across the Tasman Sea to Wellington, working a line of deep oceanographical stations on our own account. Later we carried out a sounding and dredging programme on the Lord Howe Ridge for the Department of Scientific and Industrial Research of New Zealand. We were most hospitably received at Wellington, and while we were there I was privileged to attend (with two of my colleagues) the first full meeting of the recently formed New Zealand Oceanographical Committee.

Our stay here seemed all too short and we left on November 2 to carry out an extended cruise east to long. 150° W. and thence south to the ice-edge, which we expected to find in about 60° S. From there our course was to be a zig-zag one, along 1000 miles of the ice-edge, before turning north for Dunedin. By now the weather had improved considerably, and we were able to get down to a regular echo-sounding routine. At this point I should perhaps explain that the configuration of the ocean bottom is a matter of some importance in deep-sea oceanographical work. I have mentioned the movements of the water masses, and one of the factors controlling these movements is the shape of the bottom. The presence of an extensive underwater ridge can have a big effect on a large mass of moving water. If the ridge is sharp, and rises high above the bottom, it will probably cause upwelling of the bottom water, and thus bring to the surface water rich in nutrients such as phosphates, on which the small animal life of the sea depends for its existence. Underwater ridges can also deflect a moving mass of water horizontally. For many years now we have been taking regular echo

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SERIES ONE

Birds of Eastern and North-Eastern Africa

Volume One

C. W. MACKWORTH-PRAED

and

CAPTAIN C. H. B. GRANT

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SERIES ONE **VOLUME ONE**

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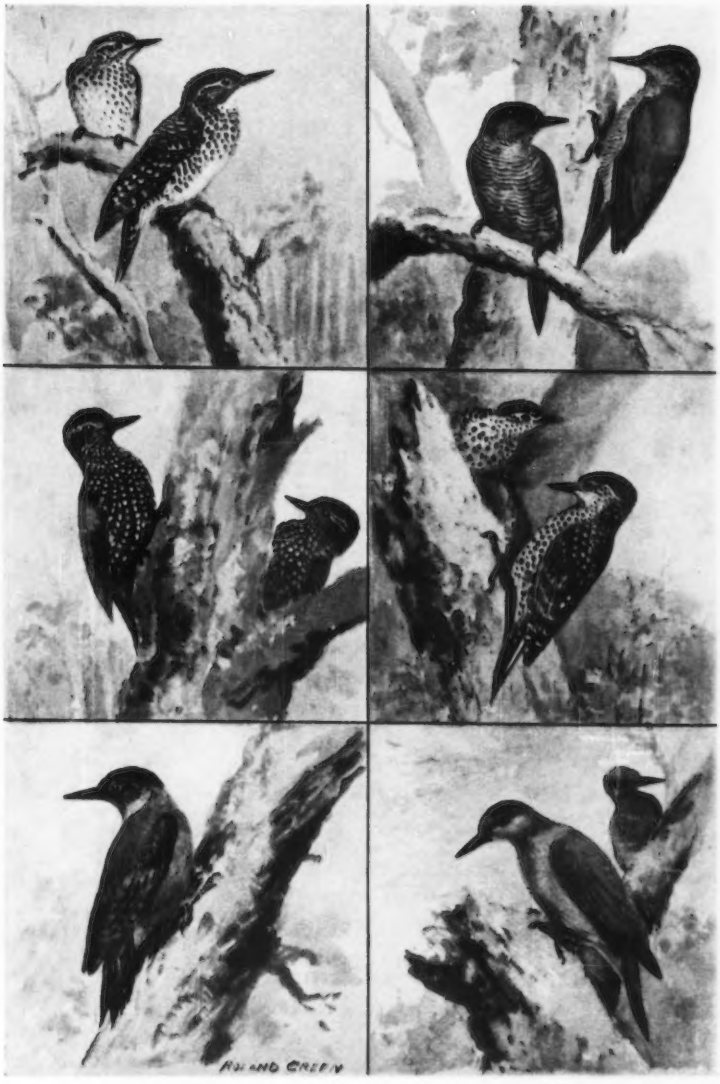


Nubian Woodpecker (p. 755)
Campethera nubica

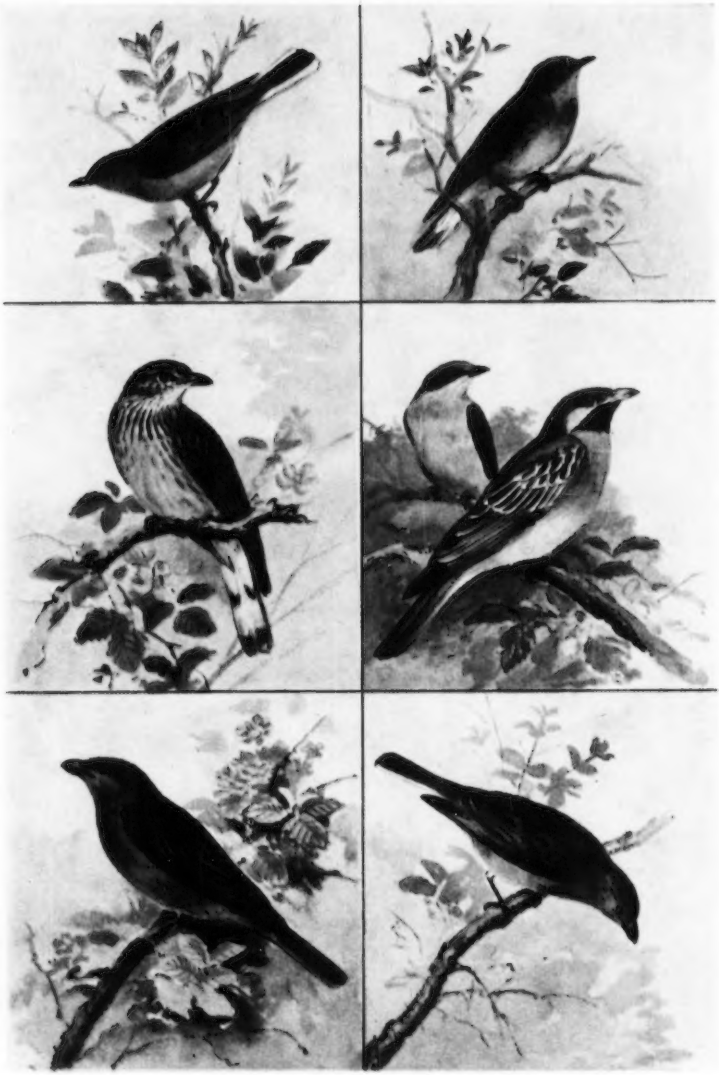
Brown-eared Woodpecker (p. 752)
Campethera caroli

Olive Woodpecker (p. 770)
Mesopicus griseocephalus

Fine-banded Woodpecker (p. 753)
Campethera taeniolaema

Little Spotted Woodpecker (p. 757)
Campethera cailliautii

Grey Woodpecker (p. 768)
Mesopicus goertae



Roland Green

Cassin's Honey-Bird (p. 747)
Prodotiscus insignis

Scaly-throated Honey-Guide (p. 741)
Indicator variegatus

Thick-billed Honey-Guide (p. 744)
Indicator conirostris

Wahlberg's Honey-Bird (p. 746)
Prodotiscus regulus

Black-throated Honey-Guide (p. 739)
Indicator indicator

Lesser Honey-Guide (p. 742)
Indicator minor

Range in Eastern Africa: The Sudan in non-breeding season.

Habits: At present only recorded from the Sudan, but might occur anywhere in north-eastern Africa during the palæarctic winter, and may even be found breeding, as it breeds in Arabia and possibly also in Egypt. A huge black bird, clumsy looking on the ground but with considerable powers of running, and with complete mastery of the air when on the wing.

Nest and Eggs: Nests in high trees or cliffs, and the single egg is white, or white with reddish blotches; about 92 × 69 mm.

Recorded breeding: Not as yet known within our area.

Food: As for other Vultures.

Call: Nothing recorded, except a sharp yelping cry when annoyed.

105 GRIFFON VULTURE. *GYPS FULVUS* (Hablizl).

Gyps fulvus fulvus (Habl.).

Vultur fulvus Hablizl, N. Nordische Beytr. 4, p. 58, 1783: Mountains of Gilan, north Iran.

Distinguishing characters: General colour dark buff; head and neck covered in white down; bill horn; ruff long and white; crop patch buff; flight feathers and tail blackish brown; frontal upper half of tarsus covered in down. A light-coloured Vulture on the wing with under wing-coverts the same colour as the breast, not white as in the White-backed Vulture. The sexes are alike. Wing 660 to 725 mm. The young bird is more tawny, is streaked below and the ruff feathers are tawny with paler centres. The nestling is white.

General distribution: Southern Europe to southern Russia, northern Africa, Sinai, Arabia and Iran; in non-breeding season to Senegal, the Sudan and British Somaliland. Occasional in more northern areas of Europe.

Range in Eastern Africa: The Sudan, Eritrea, Abyssinia and British Somaliland in non-breeding season.

Habits: As far as is known a migrant only to Africa, where it soars by day to great heights and remains aloft watching the earth below. Roosts and nests in communities on cliffs and rocks. Cowardly birds, and will not touch any animal with a sign of life left: a small dog or jackal will drive them from their prey.

Nest and Eggs: Generally a mere pad of material on a ledge of rock. Egg one, white or white with light brown flecks; about 90 × 70 mm.

LIST OF GROUPS

Ostriches — Grebes — Petrels and Shearwaters — Tropic Birds — Boobys and Gannets — Cormorants — Darter — Frigate Birds — Pelicans — Herons, Egrets and Bitterns — Hammerkops, Storks, Ibises and Spoonbills, — Flamingoes — Ducks and Geese — Birds of Prey — Game Birds — Rails, Crakes, Moorhens and Coots — Finfoot — Cranes — Bustards —Thicknees — Jacanas — Plovers — Oyster-catcher, Avocet and Stilt — Painted Snipe — Snipe — Waders — Phalaropes — Coursers and Pratincoles — Egyptian Plover and Crab Plover — Skuas — Gulls — Terns — Button Quails and Quail-Plover — Sandgrouse — Pigeons and Doves — Cuckoos and Coucals — Turacos — Parrots, Parakeets and Lovebirds — Rollers — Kingfishers — Bee-eaters — Hornbills — Hoopoes — Wood-Hoopoes and Scimitar-bills — Owls — Nightjars — Mousebirds — Trogons — Barbets — Honey-Guides and Honey-birds — Woodpeckers — Wrynecks — Swifts — Broadbills — Pittas

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soundings wherever the ship went, but with the modern method of automatically recording these soundings continuously on paper, not only can we learn more about the general trend of the main underwater features, but we can examine the ocean bed itself in some detail.

Resuming our cruise we began a continuous sounding record shortly after leaving Wellington, and this was continued out of Cook Strait, across the southern end of the Kermadec Trench to the Chatham Island plateau and then out into deep water, at 2800 fathoms, east of these islands. This run occupied sixty hours and covered approximately 500 miles of the ocean bed. Shortly after this, routine hourly soundings located an unexpected sea mount, and a continuous record was taken which showed that at the point where we crossed it this sea mount rose some 14,200 feet above the general level of the bottom here. The least sounding recorded was 366 fathoms. An attempt to dredge at this spot was not a success.

Fine weather still prevailed when we reached 150° W., in 45° S., and turned south for the ice. A series of seven deep oceanographical stations was worked on this run, in reasonably good weather and, having steamed for some hours through brash and loose pack, we met the main body of ice in 60° 46′ S., on November 17. It was obvious that the break-up had only just started as we did not sight any ice until we saw an isolated berg in 56° S., and it was not until we reached 59° S. that they became a common sight. The main body of pack ice was composed of old and worn ice, much stained with diatoms. There was no sign of any newly formed ice.

For the next eight days we were working westwards, on a zig-zag course along the ice edge. Surface and shallow depth nets were towed three times a day on this run, so that our observations could be comparable to those taken on the ice edge before the war. On reaching 175° (by which time the ice edge had retreated to 62° S.) we turned north for Dunedin. Bad weather on this run not only severely hampered our efforts to work a line of deep oceanographical stations, but prevented us from making a sounding run up the slope to the island shelf of New Zealand. Improved conditions after reaching the shelf enabled us to confirm the existence of a shallow bank located by the *Discovery II* some years before the war. It was not until later in the commission, when we were seeking an explanation of the distribution of salinity and dissolved oxygen in the deep water of the Tasman Basin, that we realized just how valuable a good line of stations here might have been.

I mentioned earlier that we had been able to make at least one close examination of the Antarctic Convergence during this commission. This convergence may be described simply as an area where the Antarctic surface water sinks beneath the warmer water of the Sub-Antarctic zone. It stretches right around Antarctica, though for several reasons it is more strongly marked in some sectors than in others. One place where it is normally well defined is near Macquarie Island, which lies some 500 miles south-west of New Zealand. When we left Dunedin on December 8 it was for this convergence area that we were bound, via Macquarie Island. There we were to land mails, stores and a relief cook for the Australian National Antarctic Research Expedition. We were also accompanied by two meteorological physicists from the C.S.I.R.O. meteorological physics laboratory at Melbourne.

On the way to Macquarie we ran a continuous line of echo soundings, to see if there was any evidence of a ridge connecting Macquarie with the New Zealand island shelf. Such a ridge has been tentatively shown on some maps, but in my opinion the evidence for its existence was very flimsy indeed. The soundings showed a very diverse and rugged bottom at moderately great depths and although one line of soundings such as these cannot disprove the existence of a ridge here, I think I will be able later to show, when I come to discuss the physical oceanography of the deep waters of the Tasman Basin, that the presence of a ridge here is improbable.

On arrival at Macquarie we landed the mail, and on the following day sailed for the Convergence. It was clearly shown by a drop of over 2° C., and when we were certain that we had crossed it we turned north and commenced our closely spaced line of observations across it. Two full and three bathythermograph stations were worked and the discontinuity in the upper layers was very sharply marked indeed. At the same time our meteorological experts were making their observations and when I saw them in Melbourne, some five months later, they were very pleased with the preliminary results. It had been intended to follow the Antarctic Convergence here to the west, by means of continuously recorded surface temperatures. But the weather was worsening rapidly as we crossed the Convergence on our northerly course and by the time we had completed the last full set of observations a strong gale was blowing. In these conditions it was no use following the Convergence, so course was set for Melbourne.

Christmas and New Year were spent here, and we left on January 2 for Fremantle with a programme of three lines of off-shore stations to work for the C.S.I.R.O. Fisheries Division, and hopes of working a line of coring stations in deep water off south-west Australia. The weather was marvellously fine for the famous Bight and the ordinary lines of stations were completed without a hitch. We were not so lucky with the coring stations as on the first station we unfortunately suffered an accident to the mechanical drive of the cable traversing gear on the main winch. The traverse rollers had then to be manhandled backwards and forwards while we recovered the corer, not to mention 5500 metres of warp. When the tube was recovered the external markings led us to believe that we had got a reasonably good core (probably about 12 feet long), but when the lining tubes were extracted we found only 15 inches of yellow mud in the first tube. The nosepiece was found to be blocked with a brownish black substance and subsequent analysis on board revealed the fact that this hard black powder was probably from a small meteorite, which the heavy corer must have struck fair and square and forced some 10 or 11 feet into the mud or clay. North-east of the point where we were working is the Nullarbor Plain, and I understand that over a wide area of this plain these meteorites are common. There seems no reason why they should not also have fallen over the Bight.

The winch was repaired at Fremantle and on February 2 we left for another line of stations at the southern end of the 90° E. line. The weather was generally good, with only occasional gales, and we were able to work ten full stations between 40° S. and the ice edge, which lay in 65° 08′ S. At this time of year (mid February) and in this sector, there is a reasonable

chance that the coasts of Antarctica will be free of sea ice, and that an approach to the land or the shelf ice will be possible. But in 1951, we found as we approached the Davis Sea to the west of the Shackleton ice-shelf, that very heavy pack with innumerable large bergs imprisoned in it blocked our way when we were still some 90 miles from land. We turned away north-east, hoping that this might only be a local condition due to ice not coming away from the Davis Sea, and that we would not only be able to sight the Shackleton ice-shelf but possibly approach Sabrina Land, which lies farther east. On this no landing has ever been reported. However, we were continually forced away to the north-east as we worked our way eastwards, and although we made some miles to the south-east after reaching long. 96° E., it was not long before heavy pack again forced us to the north-east. On February 23, when we were in 64° 07′ S., 103° 07′ E., Captain Blackburn told me that consideration of fuel supplies made it advisable for us to leave the ice edge and set course for Sydney. We had hoped also to see something of the French Expedition then in Adèlie Land, with whom I had exchanged wireless messages, or their ship, the *Commandant Charcot*. But she was too far south and east for us to make any further divergence from our course.

The next two-and-a-half months were spent refitting at Sydney, and we left late in May for Dunedin on the first leg of our winter circumpolar cruise. On the way across the Tasman Sea we worked a line of deep stations, parallel to but 200 miles south of the line worked in October the previous year. This line produced some very interesting results and, on the eastern side of the Tasman Basin confirmed the observations made by *Discovery II* in 1932, especially about the circulation of the deep and bottom water.[1]

After refuelling at Dunedin we left on May 31 for the long trek across to the Falkland Islands. Our first objective was a line of oceanographical stations in a south-easterly direction towards the ice. When the preliminary sections drawn from these observations are considered in conjunction with those of the southerly line across the Tasman Sea, it would appear that there is some evidence for assuming that the deep water from the area to the south-east of New Zealand penetrates into the Tasman Basin. The isotherms are inconclusive at all depths, but in both the distribution of salinity and dissolved oxygen there appear to be reasonable grounds for thinking that some of the deep water of the Tasman Basin has its origin east of New Zealand. Since the Tasman Basin is closed to the north the only other possible source for the inflow of deep water is from the Indian Ocean water flowing eastwards south of Australia, and over the least strongly marked part of the ridge which runs in a southerly direction from Tasmania. This water is however much less saline than the Pacific deep water and, in my opinion, the isohalines in the Tasman Basin show that Indian Ocean water forms the deep and bottom water on the western side of the Basin, with Pacific water to the east, and a strongly marked area of mixing between. But no definite conclusions can be

[1] The primary objective for the 1950–51 voyage of *Discovery II* was the completion of a general oceanographic survey of the Southern Ocean. This survey, which has been under way for many years, comprises all branches of oceanography, and references such as this, made to our earlier observations, are often difficult to amplify without going into much technical detail.

reached without a further line of stations to the south, say from Hobart to Auckland Island, and a north-and-south line in perhaps 155° E.

If this flow of deep water westwards around New Zealand into the Tasman Basin does in fact take place, then there can be little doubt that there is no ridge connecting Macquarie Island with the New Zealand Island Shelf. However the ruggedness of the bottom in this area shows that there may be isolated peaks. The line of stations from Dunedin to the ice, which was found in 65° 45′ S., 143° W., occupied us for eleven days, in generally good weather. As the weather was still fine when we reached the ice edge we decided to push into the ice to see if we could find a clear-cut edge to the pack, instead of the gradual transition from an oily scum to closely packed new pancake ice. This, with sludge ice between the pancakes, appeared to be the usual condition prevailing in winter. No clear-cut edge of heavier ice was found, only a heavier concentration of pancakes, and as air and sea temperatures were remaining low, and the new ice thickening rapidly, we retraced our course to open water through 9 miles of ice which had visibly thickened since we had entered it a few hours earlier.

The weather was not so good when we continued our run to the east. It was generally boisterous, with strong or gale force westerly winds, but all station work was satisfactorily completed. On this run across to 80° E., where we were to turn south for the ice again in winter and repeat stations worked previously in this meridian at other seasons, we moved north of the Antarctic Convergence and were in lat. 59° S. when we turned for the ice. Conditions on the way south made station work difficult and we found the ice in 63° 52′ S., some considerable distance north of the estimated position. The weather remained poor during the run up from the ice to the Falkland Islands, but most of the station work planned was done. Port Stanley in winter is not always blessed with fine weather. There is usually a strong wind, and this year was no exception. These conditions do not however deter an enthusiastic party of experts on the ionosphere, some of the staff of the Falkland Islands Dependencies Survey, who are trying to sort out the little-known weather conditions in those parts.

We sailed from Stanley in a south-westerly gale, which increased to storm force when we were clear of the land, and we were glad to heave-to for eighteen hours. This gale was however followed by a spell of five days of remarkably fine weather and we were able not only to work a line of stations across the Scotia Sea, but to take a full series of echo soundings across one of the few parts of the sea where soundings are sparse. We met the ice south of South Georgia, in much the expected position, and for some distance eastward the trend of the edge was in the accepted direction; that is to say north-easterly. But as we neared the South Sandwich Islands, the ice edge took up a more east-and-west line and we were able to pass through the Group close to the Candlemas Islands. It was now blowing strongly from the west, and snowing, with a consequent low visibility. However, Vindication Island was located by radar and we passed about 2 miles south of both that island and Candlemas Island itself. Close pack was to the south and east of us.

The main peaks of both islands were shrouded in mist and low cloud but

the northern peak of Candlemas was clearly seen and it appeared to be still as active volcanically as it had been during our running survey of the Group in 1931.[1] Even at a distance of 3½ miles steam and smoke could clearly be seen with the naked eye, rising from the fissures in the southern slopes. After leaving here we had hoped to record a line of soundings across the little-known very deep South Sandwich Trench, in the same latitude as Candlemas Island, but heavy pack forced us north before we could continue eastwards in open water. We were now running before a strong north-westerly wind and echo sounding became difficult, even when we reduced speed during the dark hours. We lost the continuous echo trace, at 3459 fathoms, on the slope down to the Trench. Although a sounding of 3732 fathoms was clearly recorded a few miles farther east, we did not pick up the continuous echo trace again until we were well up the slope on the western side, in 3234 fathoms.

Our next contact with pack ice was in 57° 22′ S., 10° 44′ W., in poor weather and bad visibility, and the ice was quite different from any other I have ever seen at sea in the Antarctic in winter. The floes were small, round and thin, though definitely of the usual pancake shape. But there was no raised rim such as normally occurs, and the floes had a brittle and transparent appearance. It was rather as if they were composed of hard ice, instead of a mass of ice crystals, with overlying snow and frozen spray. When the ship passed through them there was a sharp crackling sound—quite different from the smooth "swish" of a passage through ordinary newly formed pancake ice. Scattered among these small, hard floes were pieces of worn, diatom-stained ice. The area in which this ice was found should normally be clear of ice in the summer, though it is possible that the very cold surface water here (of Weddell Sea origin) may occasionally prevent the disappearance of all the pack. There can be little doubt that these small hard pancakes were not the remains of the previous season's ice, but were of fairly recent origin. One explanation may perhaps be offered; did we arrive on the ice-edge at a time when a period of relatively warm winds from the north-west had just had enough time to start melting the outer fringe of new pack ice which was relatively heavy? On the date when we met the ice the edge was almost at its northern mean limit for winter and we ourselves had experienced strong north-westerly winds for three or four days previously.

At this point we left the ice and headed for Simonstown. The weather was bad, and little scientific work was possible, but with a quarterly gale we made good time, though life was a little uncomfortable. After repairs to some gear damaged in heavy weather we left for Durban to refuel, since on our next leg to Fremantle via the ice-edge, Kerguelen, and Heard Island (a distance of nearly 6000 miles) we would want all the oil we could take, and the distance from Durban was shorter by some 250 miles. We had, admittedly, the promise of a small amount of diesel oil from the A.N.A.R.E. reserve dump at Kerguelen, but even when mixed with boiler fuel this oil is very extravagant for use in furnaces.

We left Durban on a south-easterly course on August 16, and for some days afterwards enjoyed very fine weather. Continuous sounding records

[1] 'Discovery Reports III,' 133–198.

totalling some eighty hours of steaming were obtained on the Prince Edward–Crozet Ridge and some very interesting features were recorded. Several sea mounts were located, one of which rose 13,800 feet above the general level of the ridge and was remarkable for the steepness of its slopes. I am not at all certain that these sea mounts were isolated features. I think they were part of a chain of submarine mountains, and I am sure that many other isolated underwater peaks reported in other parts of the world will, with a more detailed survey by modern echo-sounding methods, prove in each case to be part of a larger feature.

By the time we reached the Antarctic Convergence the weather had reverted to something a little more like winter conditions. Gale succeeded gale with monotonous regularity, but we were able to complete our line of deep oceanographical stations between Durban and the ice-edge, which we met in 59° 15′ S., 64° 05′ E. The stormy weather from the west continued as we came up from the ice to Kerguelen and we were glad to anchor off the French station at Port aux Français, early on September 2. Contact was established with the French party, who were under the leadership of M. Armengaud, and after landing fresh provisions which we had brought for them from Durban, we set off for Port Jeanne D'Arc, to collect oil for ourselves and for transport to Heard Island. For this short trip, which was in enclosed waters, three of the scientific staff stayed ashore at Port aux Français, and were replaced by three of the French party.

Since the main channel to Port Jeanne D'Arc was still reported as dangerous to navigation, because of mines laid there during the war, we had to approach via the north-eastern end of Long Island. This was through a narrow gap between two small islands, followed by a sharp left-hand turn. It was dark when we arrived off the old whaling station where the dump was situated and we were unable to secure to the end of the much-decayed jetty that night. It was very squally the next morning and it was with difficulty that we got the ship moored across the end of the jetty. There was little change in the weather during the next two days and the job of oiling from drums was far from easy. However, by working day and night, we managed to strike down about 35 tons for ourselves and secure about fifty drums on deck for Heard Island. We had a fine day to begin with on our return to Port aux Français but it became very squally later and, by the time we anchored, boat work was out of the question. The exchange of personnel was however effected in a lull early the following morning, and we left for Heard Island. It was an uncomfortable passage, with a westerly gale on the quarter, and the island was shrouded in snow and mist when we approached on the afternoon of September 7. But with the aid of radar and echo soundings, we were able to anchor off the A.N.A.R.E. base in Atlas Cove some time before dark. Weather conditions were then poor, with wind, snow, and sea driving into the anchorage. So, after floating off the oil drums and collecting the mail, we sailed again four hours later.

From Heard Island our course again lay south-east towards the ice, which we hoped to contact in 80°–85° E. It was now very cold, with strong, squally winds and heavy seas and little scientific work was possible. We reached the vicinity of the ice, in 56° 50′ S., 80° 42′ E., two days after leaving

Heard Island, and then turned away for Fremantle, where we arrived on September 20 after a cruise of 5723 miles from Durban, in thirty-five days. Our arrival in Western Australia homeward bound completed our work in the Southern Ocean, and since our arrival there outward bound the ship had steamed only 19 miles short of 40,000 miles (more than half of which had been done in winter). It was with a certain amount of relief that we looked forward to several months' better weather when on the way home.

For most of our work in the Southern Ocean we were accompanied by guest scientists from the various Dominions. Rochford and Spencer, of the Fisheries Division of C.S.I.R.O., were with us for the first winter cruise in August 1950. Gartner and Jitts of the same Division helped with the local work between Melbourne and Sydney, and the New Zealand Government sent us Bary (of the Defence Science Corps), and Dawbin (of Victoria College, Wellington), on our long summer cruise into the Pacific. For the Dunedin–Melbourne trip, via Macquarie Island, we had with us Deacon and Taylor, from the Meteorological Physics Division of C.S.I.R.O. In Fremantle, in February 1951, we were joined by Ealey, a biologist on the staff of A.N.A.R.E. With the exception of the refit period in Sydney, he remained with us for the remainder of the circumpolar cruise. Cassie, of the New Zealand Fishery Department, came across the Tasman Sea with us at the beginning of this cruise. We were glad to have these fellow-scientists from the Dominions with us and I hope that both sides benefited.

For the homeward voyage we left Fremantle on October 2, bound for 30° S., 90° E. We were to repeat northwards, in spring, the line of deep oceanographical stations we had worked when outward bound in June 1950. The weather was extremely fine on the run out to the west and we worked two stations with the Kullenberg Corer. Despite a certain amount of trouble with our main winch we managed to raise moderately good cores. We then tackled our line of deep stations to the north and ten in all were successfully completed without other than minor incidents. The preliminary sections drawn from these results reveal some interesting features and, not only from the bottom contour, but also from the distribution of salinity and oxygen, we are led to believe in the possible existence of an east-and-west running cross-ridge in the Indian Ocean, about 14° S. Antarctic intermediate water can be traced to 10° S., and the bottom water to 9° S., but there is every indication of a different system of circulation of the water masses at all depths north of this point.

On the completion of this line we worked another coring station, but again only raised a moderately good core. We reached Colombo on October 23, and left again on October 30, for Fadiffolu Atoll, in the Maldive Group of Islands, where we hoped to find a rare Shearwater believed to breed there. We were possibly a little early for the breeding season but although the natives obviously knew of the bird no traces of past or present burrows could be found on the two islands visited. While on the subject of birds I may mention here that the N.I.O. has recently instituted an oceanic bird-ringing scheme and, during the second part of the commission we ringed forty-one birds, ranging in size from albatross to almost the smallest petrel. A blue petrel must have followed the ship, after being ringed and released, because

it came on board again three nights later, when we were 400 miles east of the position in which it was ringed. All ringed birds were measured and any peculiarities noted.

After leaving Fadiffolu we worked another coring station, this time most successfully, raising a core of just over 29 feet (only a few inches less than the maximum obtainable with our tube) and then continued our way towards the Gulf of Aden. While still in deep water off Cape Guardafui the echo-sounder recorded yet another sea mount nearly 14,000 feet high—the third of this magnitude to be recorded this voyage. The least depth was 242 fathoms. Later, an attempt to core in deep water south-east of Sicily was not successful. The first shot failed owing to a defective valve in the nosepiece, and the second shot almost certainly hit a war wreck. By the time we were ready to have another attempt the weather had deteriorated to such an extent that the operation was abandoned, and we continued with our sounding programme.

These soundings off Malta concluded our scientific work for the voyage, and after a brief stay at Gibraltar, we reached Plymouth on December 6. The main objective for this voyage was to complete, as far as possible, the general oceanographic survey begun by the Discovery Committee in 1925. Much useful work was done and the more important results include observations in the deep waters of the central and southern parts of the Indian Ocean, a more complete understanding of the system of deep water circulation in the Tasman Sea and Basin, and valuable information on the distribution of Antarctic pack ice in winter and on the delineation of the ocean bed. I would just like to mention briefly some details of the sounding work done. Apart from routine soundings taken when the weather permitted, the deep machine, which had, theoretically, an unlimited range, was run for nearly one thousand hours, in continuous spells ranging from one to sixty-nine hours. Fourteen of these records extended over twenty hours each, and a conservative estimate of the miles of ocean bed we were thus able to survey would be about 7500. The deep scattering layer was located on a number of occasions, and when one considers that a large part of this work was done in winter, I think that the results demonstrate the efficiency of the modern British echo-sounding instruments.

All the scientific results must however be considered in relation to the vast amount of data collected in the earlier years of our work, and, with only a limited staff available to work on them, it may be some time before the value of these later observations can be fully assessed.

I would like to thank all those authorities (too many to name) in Australia and New Zealand, who, on our frequent visits to their waters, made us so welcome ashore and granted us so many facilities. I would also like to take this opportunity of thanking our Captain, Commander John Blackburn, D.S.O., R.N., and his officers and men for their efforts on our behalf. Only two of our complement had previous experience of this kind of work and it says much for the keenness of both the young scientific staff, and the crew, that we were able to approach once again our pre-war standard of station work in all weathers.

DISCUSSION

Evening Meeting, 9 June 1952

Before the paper the PRESIDENT (Mr. J. M. WORDIE) said: Dr. Herdman has probably had more experience of voyaging in the Antarctic Ocean than anyone else at the present time. He joined the staff of the Discovery Committee in 1925, and he has told me this evening that he remembers clearly the interview he had with the Discovery Committee when he was appointed, and his nervousness on that occasion. He really had no need to be nervous because no one has been a more consistently loyal member of the staff of the Discovery Committee, or shown greater ability in carrying out oceanographical work on board ship than has Dr. Herdman. He sailed in the old *Discovery* in 1925–27 and the voyage he will describe to-night is his fourth with *Discovery II*, each voyage into the Antarctic lasting about eighteen months. Dr. Herdman himself knows more about sea ice in practice than does anyone else.

Dr. Herdman then read his paper.

The PRESIDENT: We have with us Mr. Cook, Chief of the Royal Naval Scientific Service, responsible for the National Institute of Oceanography for which *Discovery II* worked.

Mr. W. R. J. COOK: There are, Mr. President, one or two matters on which Dr. Herdman, naturally, could not touch and to which I should like to refer.

The National Institute of Oceanography came into being on 1 April 1949. The two Research Ships, *Discovery II* and *William Scoresby*, which belonged to the Discovery Committee, were purchased by the Admiralty and presented to the Institute. Both ships had been under requisition during the war, and it was necessary for them to have extensive refits, both to equip them for the scientific work and also to meet the revised requirements of the Ministry of Transport for safety of life at sea. The *William Scoresby* sailed from the United Kingdom in January 1950, and *Discovery II* sailed in May 1950. The re-fitting, equipping and manning of these ships and the organization of two major expeditions within such a short time of the foundation of the Institute was no mean achievement. During the whole of that time Dr. Herdman was particularly charged with the supervision of the fitting out of the ships. With the exception of Dr. Herdman and one petty officer, all the scientific staff and the officers and men of *Discovery II* were new to the ship. In these circumstances the production of such an effective team is a tribute to his ability and energy as the leader of the expedition.

I would also like to mention the gratitude of New Zealand and Australia for the cooperation they received from Dr. Herdman and his party. This is particularly gratifying to the National Institute of Oceanography since Australia and New Zealand contribute to the funds.

The data collected by Dr. Herdman and his party of scientists will, with what has gone before, enable a reasonably consistent survey of the Southern Ocean to be written. This will take several years and during the time it is not expected that the *Discovery II* will make a further voyage to the Southern Ocean. Instead, the *Discovery II* will try to further the understanding of some of the basic processes which influence the physical conditions of life in the sea. In particular much of the effort will be devoted to studying the process by which there is interchange between the air and the sea. On the biological side much of the effort will be devoted to testing new methods of soundings. All these will take place probably in the Atlantic but certainly nearer home than

last time, which is just as well in view of the economic state in which we find ourselves. With rising costs and stable grants it would have been impossible for the *Discovery II* now to have made the Southern Ocean voyage which Dr. Herdman has completed. So that we must congratulate him not only on a fine achievement but also on a very timely one.

Dr. N. A. MACKINTOSH: My share in the expedition has been largely concerned with preparatory stages, and the only part I took in the actual voyage itself was a rather pleasant trip from Plymouth to Malta at the beginning of the voyage and before the hard work began; obviously it was only later when they got down south that their work became really hard. On the charts of the ship in the Antarctic, there are tracks representing a series of points at which elaborate and painstaking observations were made on the physical oceanography, the chemistry and the plankton in the water from the surface all the way down to the bottom. Of course those observations were made mostly in the winter when weather conditions in the Antarctic are very bad, when the work itself is hard monotonous work, and the ship is at sea for about 30 per cent. of the time.

I wish to make it clear that although Dr. Herdman was able to give some indication of the scientific work carried out, on a voyage such as that one cannot say what the main results of the commission are until a much later stage. This commission was mainly for the purpose of filling certain gaps in the previous work, and it was necessary to run to schedule in order to get the ship to the right place at the right time of year. That is not at all an easy thing to do. It is very much to the credit of Dr. Herdman and Captain Blackburn that they were able to do it and to complete the programme satisfactorily.

THE WATER BENEATH THE EGYPTIAN WESTERN DESERT

G. W. MURRAY

THIS PAPER ADHERES strictly to the textbook definition of "artesian water" as that derived from springs which rise above the surface of the ground by natural hydrostatic pressure, as they do in Artois in France. That is to say, the numerous deep wells sunk through the mud of the Nile Valley into the sands and gravels beneath do not qualify for the description "artesian" since the supplies they tap lie well below the surface and the water therein has to be raised by pumping. Practically the whole of the water below the fields of the Nile Valley and the Delta is derived from the river itself. Naturally, its flow through the sands is slower than that of the free-flowing Nile; and so it has come about that a summer supply can be obtained from these beds when the river itself is too low to fill the canals which take off from it. But this supply has to be raised by pumping and so has no right to be called, though in Egypt it commonly is, "artesian." Below the First Cataract the Nile has cut its channel through a series of sedimentary and mainly porous beds, and the river water that enters them seeps away at a steep slope on either side, so that a bore sunk at any distance from the cultivation has a poor chance of striking the Nile water table at a depth profitable for exploitation. The Nile is thus losing water to the desert nearly everywhere along its course. For this loss the compensations are slight. After rain, the river is sometimes discoloured by muddy water which has rushed from the hills of the Eastern Desert down the wadis to the Nile. And at all times, there are small seepages below ground down the courses of these normally dry tributaries. But the total amount of Egyptian rainfall is so small that its contribution may be absolutely disregarded in any estimate of the Nile discharge.

The artesian water of the oases

The water of the oases is however true artesian water and has nothing to do with the Nile. It is "fossil water" inasmuch as it has been imprisoned in the rocks for thousands of years; indeed, the lowest layers of all may date back to the Pliocene. Yet, though confined, it is still subject to the law of gravity and it has been flowing all the while towards the Mediterranean down a gradient, as the map shows, of about 1 in 2000; some five or six times steeper than that of the Nile. Were this not so, we should have no overflowing water in the oases; it would stay put in the wells. Nor, as is commonly believed in Egypt, is it absolutely confined to the Nubian Sandstone. Water knows no geological boundaries and will flow downhill quite readily into Cretaceous, Eocene and Miocene strata. Admittedly, when it does so, it usually becomes contaminated with salt and ceases to interest the agriculturalist. The idea that the water supplies of the oases were derived from rainfall in Dar Fur was first put forward by Gerhard Rohlfs; [1] and, more than

[1] G. Rohlfs, 'Physische Geographie und Meteorologie der Libysche Wuste.'

forty years ago, the late Sir Henry Lyons recommended [1] investigation of the theory that there existed a general water table below the Libyan Desert. In 1927, Dr. John Ball gave the result of such a research to the *Geographical Journal*,[2] accompanied by a map on which he drew contours joining points having the same static head above sea-level.

In 1936, Dr. Sandford extended Ball's contours over the north-western Sudan.[3] In his map, so far as it dealt with Egypt proper, he left them unchanged. But freshly obtained levels for the springs at Salima (247 metres) and Laqiya (346 metres) caused him to alter them considerably in the Sudan. The level for Salima came out 23 metres lower and that for Laqiya 44 metres lower than those Dr. Ball had predicted for those places; largely because, in 1927, Dr. Ball was ignorant of the great fall in the water table south of Kharga Oasis, which is now known to have taken place in recent geological time. In 1940, the evidence was reviewed by a Swedish engineer, Dr. Hellstrom,[4] who redrew Ball's underground water contours for Egypt on the assumption that the water supply of Bahariya Oasis was either derived from quite another water-bearing stratum than those below Kharga and Dakhla, or that the basic water table was there supplemented by "local rainfall on the surrounding plateau." But the levels in Bahariya Oasis, where there is no local rainfall, can hardly be separated from those observed in the southern oases, as Hellstrom suggested; and some other theory than his must be devised to include Bahariya in the general scheme.

Elsewhere, Hellstrom's contours, though more rigidly interpolated from the observed data than Dr. Ball's, closely resemble them. But, perhaps owing to lack of local knowledge, Hellstrom's interpretation of them and of the "lines of flow" at right angles to them, has led him to place "intake beds" or sources of supply in two quite rainless localities: one between Sarra and Kufra, the other just west of Bir el-Atrun.[5] Hellstrom considered however that it might take rainfall some 100,000 years to percolate through unfissured sandstone from his "intake beds" to the Qattara Depression. Though we may suppose the sandstones to be fissured and the rate of percolation rather faster, it is very probable that during the Middle Palaeolithic period, some 70,000 years ago, the above localities were considerably rainier than they are to-day. But if he is right, and these areas, though now among the driest in the world, were once the intake beds, the future of the Egyptian oases, dependent upon a supply cut off tens of thousands of years ago, is dismal indeed. And the great drop in the water table, observed by Beadnell at Bir el-Misaha, where his shaft passed through 22 metres of moist sandstone before it reached actual water-level, would require no further explanation.

Yet one sees the massif of the Ennedi mountains, over 1300 metres high, to

[1] H. G. Lyons, "Some unsolved problems of the Nile Basin," *Cairo Scientific Journal*, March 1908.

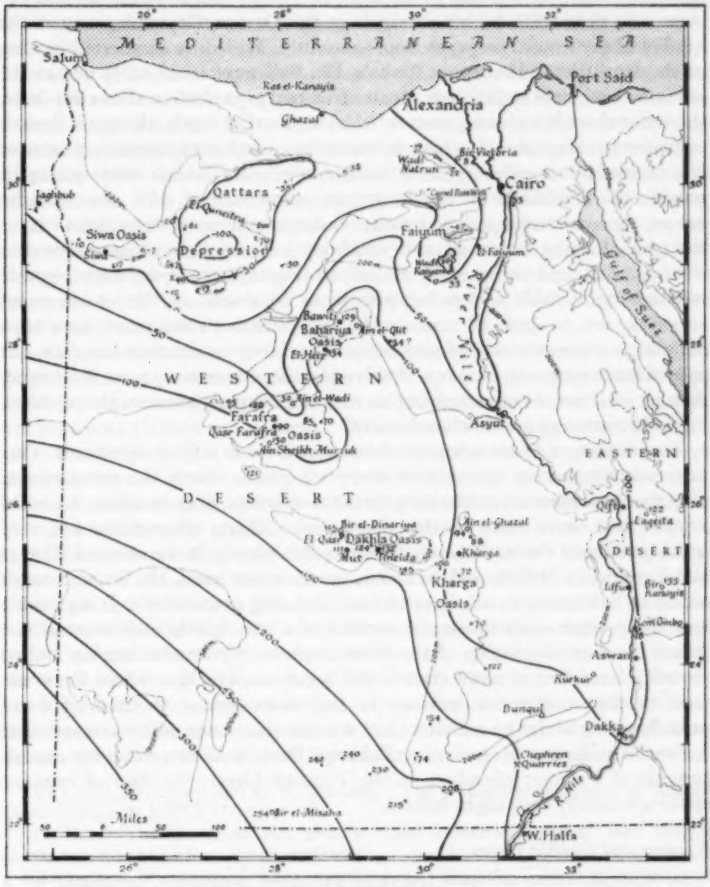
[2] J. Ball, "Problems of the Libyan Desert," *Geogr. J.* August 1927. (Reprinted by the Survey of Egypt with an Arabic translation as "The artesian water supplies of the Libyan Desert," 1945.)

[3] K. S. Sandford, "Sources of water in the N.W. Sudan," *Geogr. J.* May 1935.

[4] Bo Hellstrom, "The subterranean water in the Libyan Desert," *Geografiska Annaler*, 1940, 3 and 4, 206–39.

[5] "Bir Natrun" on old maps.

the south of Hellstrom's first "intake beds" and to the west of his second; and there is really no need to look on the nearer side of those hills for the sources of supply. Also, as Dr. Sandford has pointed out, the underground channel beneath the Wadi Hawar [1] acts as a natural conduit for the run-off



The Libyan Water Table

from the Ennedi highlands for some 400 kilometres to the east. From this channel, it leaks as it goes into the Nubian Sandstone northwards towards Egypt.

In the map of Egypt accompanying this article, many of the changes in

[1] "Wadi Hawa" on former maps. I owe the correct form to Mr. Michael Mason's book, 'The Paradise of Fools.'

Dr. Ball's contours of 1927 are due to researches initiated by Ball himself. Like Ball, I have ignored the "perched aquifers" of Kurkur and Dunqul which possibly derive their supplies from local rainfall or, more probably, from "fossil water" trapped in the rocks since the last pluvial period. One important correction is due to the new level at Bir el-Misaha; and others to three salt wells sunk by Mr. Walpole in the Qattara Depression to test the quality of the inward seepages from the south. Misled by an aneroid reading of the late Ahmad Hassanein Pasha's, Dr. Ball was considerably out in the value he assigned to Jaghbub. Instead of being 32 metres above sea-level, the water there lies about 4 metres below it. Farther south, Hasanein Pasha's value for Bir Harrash is too high by 70 metres; nor has his surprising value of 434 metres for Awadel in Kufra[1] been confirmed. Though these places lie outside the boundaries of Egypt, yet the acceptance of their new altitudes causes the 100-metre and 200-metre underground water contours to leave the map of Egypt in rather more southerly latitudes than those assigned to them by Ball, and accepted by Hellstrom. Perhaps research by geophysical methods will enable a detailed picture to be drawn of the underground seepages; for, to date, all versions (Ball's, Hellstrom's and mine) have been obliged to err on the side of simplicity. Yet, however deficient the data, our approximate contours, based on observed levels, are certainly more interesting than an ideal set of concentric circles with the intervals between them widening as the artesian gradient slackens off.

The departure of the contours from that ideal is indeed significant. One may suspect that in the salients there are places where the subterranean structure is abnormal; and be sure, in the re-entrants, of cases where the aerial erosion has eaten down to the water table. There, evaporation has very quickly reduced the static head. One sees this plainly in the oases of Kharga and Farafra; in Dakhla and Bahariya, on the other hand, the artesian water seems to be coming in nearly as fast as it is being evaporated.[2] It is possible that these latter oases lie on the summit of a very gentle arch or anticline, where the natural jointing of the rocks tends to open under tension and so permit a freer flow of water than would occur in a syncline, where the joints tend to close under compression. It may seem strange to think of water actually rising under an anticline; but it is artesian water under pressure that we are considering. In structure, Bahariya Oasis is known to be the eroded summit of a dome; elsewhere in the Western Desert the dips of exposed strata are usually very slight indeed.

Kharga and Dakhla Oases

In Kharga, there are two layers of saturated sandstone, separated by a 75-metre band of impermeable grey shale. The upper, the "Surface Water Sandstone," with a present static head of 80–90 metres above sea-level, has been almost drained of its contents, largely by aerial erosion and evaporation

[1] The loop in Dr. Ball's 400-metre underground water contour, caused by this, seems to have influenced Dr. Hellstrom in his choice of the northern "intake beds."

[2] This is not likely to be the case much longer; for Dr. Little has estimated that the output of the Dakhla wells increased by 250 per cent. during the period 1900–25. O. H. Little, "A preliminary report on the water supply of Kharga and Dakhla Oases"

in prehistoric time. On the floor of the oasis, clay hummocks which Miss Caton Thompson has shown to be the sites of "fossil springs" [1] are so common that Mr. Beadnell mistook them for lake deposits. Water for irrigation is now universally obtained from the deeper layers, and so it has come about that the static head in Kharga has been reduced by 40 to 50 metres during the last 60,000 years.[2] Yet, even in the north, the Surface Water Sandstone is not quite drained, as springs at about 90 metres round 'Ain el-Ghazal show. The water of the lower layers, which can only be tapped by deep bores, rises, when released, to a little over 70 metres above sea. These lower layers are far from homogeneous and are composed of 30 to 40 per cent. of water-bearing strata, intercalated with lenses of waterless clays. Bores up to 500 metres deep have been driven into these without coming to the end of the water-bearing beds. The deep water is warm, 30° C. (more in Dakhla), and, owing to the weight of the overlying strata, it enters the bore-holes at a much greater pressure than that from the Surface Water Sandstone. In all the oases, it is charged with gas [3] which begins to be liberated in bubbles as soon as it enters the bore. Consequently, some of the deeper wells have gushed like soda-water bottles when first tapped.

An approximate rate of flow of water through the sandstone may be deduced from the rates of discharge from some of the larger wells. For instance, 'Ain Faruqiya in Dakhla, which yields 0·1 cubic metres a second, has been sunk through 470 metres of Nubian Sandstones, 133 metres of which are water-bearing. The water content of such sandstones is known to average about 22 per cent. of the volume. So an inward shrinkage of 1 metre in the water column contained in a cylinder with a radius of 1 kilometre round 'Ain Faruqiya would make available, say, 58,000 tons of water in the bore, which, at the observed rate of flow, 0·1 cubic metres a second, would take about seven days to run off. In other words, a contraction or inward flow of about 1 metre a week is required to keep this great well flowing. But that is three times too fast for the theoretical flow of water through unfissured sandstone, assessed by Hellstrom as 1 metre in twenty-three days for a slope of 1 in 2000, that of the water table between Ennedi and the Qattara Depression. Dr. Hellstrom has suggested to me that some of this increased rate may be due to compression.[4] But that the sandstones are in fact fissured may be inferred from the cases, cited by Beadnell,[5] of interference between one well and another.

[1] G. Caton Thompson and E. W. Gardner, "The prehistoric geography of Kharga Oasis," *Geogr. J.* LXXX (1932).

[2] G. Caton Thompson, *op. cit.*, gives a "Late Lower Palaeolithic" date ending 60,000 B.C. for the earliest spring outbursts.

[3] Nitrogen in Kharga and Dakhla, according to F. Hughes, "The dissolved gases of the wells of the Western Oases," *Cairo Sci. Journ.*, September 1910, and nitrogen in Siwa, "The Armstrong College Zoological Expedition to Siwa," *Proc. of the Egyptian Academy of Science*, III (1947). But, unless Beadnell is mistaken, carbon dioxide in Bahariya, H. J. Ll. Beadnell, 'Baharia oasis,' 43.

[4] The compressibility of water (modulus E_w=21,000 kg./cm.^{2}), is a far from negligible factor when such an immense aquifer as that below the Libyan Desert has to be considered. See P. W. Werner, "Notes of flow-time effects in the great aquifers of the earth," *Trans. Amer. Geophysical Union*, 27 (1946) 688–708.

[5] H. J. Ll. Beadnell, 'An Egyptian oasis,' 144–9. The wells cited are, however, all relatively shallow ones.

Again, the total outflow of all the wells in Kharga Oasis in Beadnell's time was only two-thirds of a cubic metre a second. Since 1900, this figure has been doubled or trebled. Yet even if it was to be increased a hundredfold, it would still be inadequate to keep a lake in Kharga in being against the loss by evaporation, which, as pointed out by Hellstrom, might amount to 127 cubic metres a second from a lake surface of 2000 square kilometres. Thus Beadnell's hypothesis of a great lake in Kharga during the Roman period, already refuted by Miss Caton Thompson on archaeological grounds, has received its death blow. It is equally unlikely that there was ever a lake filling the Qattara Depression.

In Dakhla, there is no "Surface Water Sandstone" and, leaving the modern bores out of consideration, the wells are generally much deeper than those of Kharga. The soil is favourable to boring, there being nothing but stiff clay to pierce before striking the water-bearing sandstones. At Mut, in the south of the oasis, only 20 to 30 metres of this separate the water from the surface; but in the north, the dip of the beds obliges wells there to be sunk to 90 and even 100 metres before water is reached. The static head in Dakhla drops 20 metres in 50 kilometres from 132 metres at Tanida in the east to 112 metres at El-Qasr in the north. This drop is doubtless due to exploitation, for some of the ancient wells at Mut are above the 120-metre contour; and all these are said to have flowed at some time on the surface. Yet the highest water-level for a well at Mut recorded during Dr. Little's survey was only 110 metres; so we have here proof of a drop of at least 10 metres since ancient times. The temperature of the Kharga water, 30° C., is considerably exceeded in Dakhla, where it rises from 29° in Tanida to 38° at El-Qasr and as much as 39·4° at El-Dinariya. (Beadnell recorded 40·6° there in 1900.) There is no evidence of any volcanic activity in the Libyan Desert within hundreds of miles from Dakhla. So, in the absence of a magma, one must ascribe the rise in temperature to the fact that the artesian waters on their way to that oasis pass through sandstones lying beneath higher land than they do on their way to Kharga. A glance at the map shows that they really do this.

Farafra Oasis

As the fresh water percolates northwards and the Nubian Sandstone dips more slowly than the slope of the water table, some water overflows from what we may call its "home-beds" into the Cretaceous limestones and marls. These are all marine strata which lie geologically above the Nubian Sandstone, but, in actual altitude, below it. This may be seen in Farafra, where a scanty supply is obtained from beds of white chalk, perhaps 220 metres above the uppermost water-bearing beds of the Nubian. Very serious for the people of Farafra is the way in which the static head in that oasis drops from 120 metres near 'Ain Sheikh Murzuk, to 90 metres at Qasr Farafra, and to only 32 metres at 'Ain el-Wadi in the north. There it is obvious that water is leaving the chalk beds very much faster than it is coming up from below. The extent of cultivation in Farafra is much too small to account for this loss, which Dr. Ball thought might be due to seepage into the Qattara Depression. An alternative explanation might well be that the Farafra wells, all of them shallow, depend merely upon upward seepage from beds analogous to the

"Surface Water Sandstone" of Kharga, while deeper and more prolific water-bearing strata lie untapped below. Really deep bores might greatly increase the prosperity of Farafra and restore the static head until the "gulf" in our artesian contours round that oasis had been completely wiped out.

Bahariya Oasis

The Bahariya wells are sunk in the top of the Nubian Sandstone, which a domal structure has here brought to the surface. Perhaps the shale or clay ceiling of the deeper water-bearing beds is absent or fractured; for there is a very abundant flow and the static head varies from 132 metres at El-Heiz, in the south, to 116 metres at 'Ain el-Glit in the north. Such levels are 100 metres higher than that at 'Ain el-Wadi in Farafra, only 80 kilometres away. Hellstrom has rendered a real service by pointing out that the 100-metre artesian contour as drawn by Dr. Ball round Bahariya is unlikely to be correct, since it implies an improbably steep artesian gradient of 1 in 580 to the east of that oasis. The discordancy is due to Ball having accepted a level of 34 metres in "Well No. 6" at the end of the projected Bahariya railway as part of his uniform water table. But that well, though 67 metres deep, did not penetrate the Eocene strata into the Nubian Sandstone,[1] in which the Bahariya wells are situated. I am personally sure that the water in it, brackish in nature, derives from some local accumulation, and that the true static head is here suppressed by an impermeable layer. Consequently, there is a reasonable hope that if this were to be pierced, sweet water would rise in the bore nearly to the surface. I have therefore ignored the level of 34 metres in this well in drawing up my artesian contours. But these contours do not indicate that water will be found at the depths indicated by them; merely that, if a well at that point were to be deepened sufficiently, water would rise in the bore to that level.

The Qattara Depression

Beyond Bahariya, the fresh water migrates into the marine beds of Cretaceous and Eocene age "above" the Nubian. During this passage, it becomes contaminated with salt; and farther north, when the water finally emerges on the surface in the deep Qattara Depression, it is rapidly evaporated by the sun. Wind erosion has here exposed to the air over 5800 square kilometres of saturated beds and this area is being extended as rapidly as the wind can remove the sand round its margins. The main *sabakha*, the Arabic term for a marsh with a saline covering, is over 170 kilometres long. Since it lies at a slope of 1 in 5700, the dip of the exposed water table, there are sometimes feeble trickles of briny water oozing from north-east to south-west. But these are very rare. So thick is the saline crust formed by centuries of evaporation that a man can walk on it across the depression and, during our survey, light cars traversed it in many directions. But ordinarily there is only one official crossing, at El-Kuneitra; and elsewhere, vehicles venture upon it at some risk. One patrol lost a lorry and a jeep during the recent war.

No meteorological observations have yet been taken in the depression,

[1] For the strata passed through by this bore, see W. F. Hume, 'Geology of Egypt,' I, 132 and Plate CXVII.

but Dr. Omer Cooper has written thus of the adjacent oasis of Siwa [1]: "The accumulation of salt has not only sterilized the land but has had an adverse effect upon the climate. . . . In Siwa, despite the fact that there is a network of ditches with running water and the gardens are irrigated in the evenings, there is no dew. I did not see a fall of dew at any time during the period we were in Siwa, nor did I see mist. The enormous salt deposits and the great birkets (lagoons) convert the depressions into desiccators wherein the air rarely attains saturation during the summer." In view of his observations, it is difficult to believe that there can be very much evaporation through the thick saline crust that covers the salt marsh of Qattara. But such as it is, it more than balances the inward seepage. Indeed, the fact that the lowest point in the depression, −134 metres, is situated upon sand and not in the salt marsh, provokes a suspicion that inward seepage has there so failed that the aerial erosion has actually succeeded in eating a hole through the exiguous water table.

A word of caution is here necessary. When I speak of an "exiguous water table," I do not mean to imply that the whole saturated depth of the Nubian Sandstone has been drained into the Qattara Depression. For the deep bores which have been sunk in recent years in Kharga and Dakhla have revealed that the water-bearing strata persist to well below 300 metres below sea-level. And it is very probable that they lie deeper still under Bahariya and Siwa. Consequently, we may presume that the Miocene beds which the wind has exposed in Qattara and drained of their contents derived their contents from some upper sandstones only, and that the bulk of the water-bearing beds lie below, still untapped. Beneath the coast line they must lie very deep, for a bore of 7000 feet sunk by the Shell Co. at Ghazal, failed to reveal their presence. But the geological conditions beneath the plateau north of the Qattara Depression are largely an unknown quantity to the ordinary investigator; whatever may be the knowledge of them possessed by the geophysicists employed by the oil companies. They can hardly be as simple as those in the south. Indeed, from the very marked southward deflection of the plumb-line observed at all the geodetic stations between Sallum and Ras el-Hikma (Ras el-Kanayis), I should not be surprised to learn that a buried range of crystalline rocks extends inland and parallel to that portion of the north coast of Egypt.

Certainly, there exist between Qattara and the sea sufficient clay beds to prevent the waters of the latter seeping through into the depression. These were met with in the trial bore-holes for the tunnel which Dr. Ball projected to join the two; and others outcrop at the foot of the escarpment on the north side of the depression. Similar beds may bar the waters of the basic water table from passing under the Delta; for a deep bore for oil near the Pyramids did not strike water till the Nubian was reached at 506 metres below sea-level. During a twenty-five minute test, this water rose 360 metres in the bore and might have risen further, had the test been continued. It was salt in quality.

The Wadi Natrun

As wells sunk at Bir Victoria (+8 metres), the "Halfway House" on the Cairo–Alexandria road (−4 metres) and Bir Hooker (−11 metres) prove,

[1] "The Armstrong College Zoological Expedition to Siwa," *op. cit.* 8.

there is a regular seepage from the Nile into the Wadi Natrun. Yet "the large springs of warm fresh water which bubble up in or near the salt lakes themselves" [1] induced Dr. Ball to include the static level of −23 metres of the Wadi Natrun lakes in his basic water table. We may perhaps regard the Wadi Natrun lakes as evidence of a subterranean confluence of the Libyan and the Nile water tables.

The Faiyum Lake

Dr. Ball thought this lake, which is fed from the Nile, might have sunk to hydrostatic equilibrium, with his Libyan water table at its present level of −45 metres. Until about fifty years ago, its water was abnormally fresh (though not drinkable), "notwithstanding the long period through which it has been subject to evaporation and the fact of its having shrunk to dimensions very much smaller than it possessed in ancient times."[2] This Dr. Ball attempted to account for by postulating outward seepage from the bed of the lake, either to the Qattara Depression or, more probably, to the neighbouring depression of the Wadi Raiyan, whose lowest point is −60 metres. Yet, though the Faiyum depression was completely filled in past ages, as raised beaches up to +45 metres prove, there are no such corresponding beaches in the Wadi Raiyan, and one seems obliged to consider that the two depressions have never been in connection with one another.

Siwa Oasis

From inspection of the underground water contours, it would seem that the water of this oasis comes through Kufra, partly indeed from the Ennedi highlands, but largely from Tibesti. It is abundant: there are 45 square kilometres of lagoons, some 3 metres deep, between Siwa and Jaghbub. Moreover, since it emerges in the Miocene, having travelled upwards through all the wholly marine Cretaceous and Eocene strata, it is hardly surprising that it should be a little salt. Northwards, the temperatures of the oasis water sink from 34° in Dakhla and 30° in Kharga to 28° in Bahariya and 27·5° in Siwa [3] where the wells are shallow. This fall is no doubt due to the approach of the water-bearing beds, no longer the Nubian Sandstone, to the surface. Just across Egypt's western frontier, near the point where the 24th meridian crosses the 26th parallel of latitude, the theoretical artesian water contour of 200 metres is intersected by the 200-metre surface contour. Were the strata there porous, one would expect to meet with springs. In such unknown and inaccessible country both these interpolated contours may be considerably in error. Yet even so, it is very probable that if deep wells were to be sunk in this waterless region, water would rise in the bores very nearly, if not quite, to the surface.

[1] J. Ball, "Problems," 109 n. Such data as exist for the Wadi Natrun seepages will be found in A. Lucas, 'Natural soda deposits in Egypt' (Egyptian Survey Department Paper No. 22) and further discussed in Dr. W. F. Hume's 'Geology of Egypt,' I, 161–71. In view of Dr. Ball's remark about "warm springs," it is to be regretted that no temperatures seem yet to have been taken of the wells in the Wadi Natrun.

[2] J. Ball, "Problems," 111.

[3] Dr. C. L. Smith could not confirm Azadian's division of the Siwa wells into "hot" and "cold." See the Armstrong College Zoological Expedition Report.

Possible extension of the water table

In 1896, Dr. Ball observed at Dakka in Lower Nubia warm water (28·3° C.) seeping into the Nile at the 100-metre level from both banks; and he later inferred from this that the Nile had there cut into, but not through, the same water-bearing beds that supplied the oases. I say "into but not through," because these beds, which are more than 400 metres thick below Kharga and Dakhla, have doubtless a comparable thickness at Dakka, and the Nile can have made no more than a trifling incision in the top of them. Thus the Libyan water siphons under the Nile channel,[1] and reappears on the eastern side.

At Kom Ombo, too, warm water (30° C.) has been observed seeping into a number of wells sunk by the Wadi Kom Ombo Co. at distances up to 14 kilometres from the river and at levels varying from 90 to 84 metres [2] above sea. There seems to be a Nileward slope of the water table here of about 1 in 2700. Such a gradient implies, of course, a much greater height than 90 metres for the water table farther inland, away from the drain towards the river. Indeed, should there be here a basic water table like that below the Libyan Desert, one would expect, from the levels of 119 at Laqeita and 133 at El-Kanayis, to find it standing at something over 140 metres at 50 kilometres inland from Kom Ombo. Should this prove to be the case, water might be tapped not far below the surface of the great alluvial plain of Atmur Nugra, to the east of Kom Ombo.

Summary

South of latitude 28° the rainless country west of the Nile, composed almost uniformly of Nubian Sandstones [3] which dip gently northwards without either faulting or folding, provides an almost ideal laboratory in which to study the underground movement of water on a large scale. North of latitude 28°, these sandstones dip under limestones and marls and, wherever the artesian water rises through these, the salinity is greatly increased. Nearer the Mediterranean, the covering Miocene strata dip equally gently towards the sea; but, beneath these, the geological structure is probably far from simple. The artesian water beneath this desert is derived from rain which fell on the hills of the Western Sudan many thousands of years ago. Saturated beds have been exposed by aerial erosion both in the fertile oases and the barren Qattara Depression with the result that the static head has fallen greatly in these places and, on the map, the symmetry of the artesian contours has been correspondingly marred. Even in the south, far from the oases, the water table has fallen by 22 metres and there is no hope of restoring it. Yet below this level, there remains an immense mass of waterlogged rocks 400 or 500 metres thick for future exploitation.

[1] The very great thickness of sands and gravels beneath the Nile channel in Egypt proper, at least 90 metres at Qena, does not extend upstream of the First Cataract.

[2] These are 1926 levels. In all these wells, the levels have since risen owing to infiltration from the cultivation.

[3] In the present state of our knowledge, the presence of considerable "islands" of Pre-Cambrian rocks in the sandstone sea, south of Kharga, near the Chephren quarries and beneath the Gilf Kebir do not seem to retard in any way the northward flow of the subterranean water.

THE EROSION SURFACES OF EXMOOR AND ADJACENT AREAS

W. G. V. BALCHIN

THE EXISTENCE in South Wales and south-west England of a polycyclic landscape with erosion surfaces has, in most quarters, been largely accepted as a result of the observations during the past fifty years of Clement Reid, G. Barrow, A. A. Miller, J. F. N. Green, A. E. Trueman and others. But although a large measure of agreement has been reached, differences of opinion still exist on details. In the heart of the area in question lies the Exmoor region. Despite its intrinsic interest, this has received, perhaps because of its complicated character and relative remoteness, only limited attention from geologists and practically none from geomorphologists. A detailed analysis of this area was clearly called for; new evidence might be forthcoming and additional light thrown on existing problems. It was decided to approach the area *de novo* and to subject it to as many objective cartographic and morphological analyses as possible combined with systematic field mapping. The following account surveys the conclusions reached in the inquiry. A synopsis of the geology precedes the cartographic and field evidence for a sequence of erosion surfaces; then follows the evidence from the superficial deposits and the river valleys, and finally the denudation chronology is discussed.

The geological basis

Surprisingly little detailed geological material is available: the official Geological Survey maps are still based upon de la Beche's investigation of over a century ago, and for the present work it was necessary to compile, from scattered papers in various journals, a geological map on a scale of 1 inch to 1 mile. Based largely on the work of R. Etheridge (1867),[1] W. A. E. Ussher (1879), J. G. Hamling (1910), J. W. Evans (1922) and A. N. Thomas (1940) the map shows the solid geology only. Although adequate for an initial geomorphological inquiry it was soon obvious, when in the field, that much yet remains to be done in the sphere of pure geology. The present inquiry is located in the northern part of the compound major syncline of Devonian and Carboniferous rocks which constitute much of the south-western peninsula. Hence the oldest rocks exposed on Exmoor, the lower Devonian, are found outcropping to the north-east around Foreland Point. South-south-westwards, the middle and upper Devonian, and finally the Carboniferous rocks, are successively encountered. The Devonian rocks have been divided into minor subdivisions largely related to the lithology; distinction being made between the Foreland Grits, the Lynton slates and grits, the Ilfracombe shales and limestones, the Morte slates, the Pickwell Down sandstones and shales, the Baggy and Marwood sandstones and shales and the Pilton slates. The Carboniferous rocks, otherwise known as the Culm

[1] Names and dates refer to works listed in Selected References at end of article.

Measures, come in to the south of the Devonian and form a very extensive tract of country: they have been divided, mainly on fossil evidence, into the lower Culm Measures and the upper Culm Measures. The lower consists of a narrow zone of shales, slates and limestones with some chert and grit beds. The upper Measures are mainly shales with some limestones and these make up the great bulk of central Devon.

All the rocks considered so far were involved in the Armorican earth movements and extensive mountains appear to have been built up as a result of great pressure from the south. During New Red Sandstone time the denudation of these mountains, largely under semi-arid and arid conditions, provided material for deposits which are now to be found to the east fringing the Exmoor block. The first of these deposits to be laid down were the Permian breccias, red marls and red sandstones. These outcrop within the region studied in the neighbourhood of Wiveliscombe and northwards along the eastern edge of the Brendon Hills. Succeeding the Permian sands, breccias and marls are somewhat similar; Triassic conglomerates and red sandstones. These deposits have been fully described by A. N. Thomas (1940). Thomas demonstrates how in pre-Triassic time a block-fault system led to the formation of depressions, at first isolated but later joined, such that the New Red Sandstone deposits are similar over the whole area. Certain of these faults appear to have moved some hundreds of feet in late Triassic time, so dislocating some Triassic deposits and also the sub-Triassic surface—a fact of considerable importance when dating the erosion surfaces of the Exmoor region.

It seems clear that in the Minehead area and along the eastern edge of Exmoor the basis for the present-day topography was being formed at a very early date. The block faulting is an important control, and the present-day lowlands now exist in softer sediments preserved in the angle between the dip slope of one fault block and the scarp-faulted edge of the next block. Doubtless more recent strata than the Triassic have since been removed from much of the area, and in this respect the topography can be regarded as partly exhumed—the small outlier of Liassic rock near Selworthy points to a much greater extent of the Lias cover which comes in on the extreme north-east of the region. The steep south-eastern edge of Exmoor may also be similarly faulted, but much of the evidence remains buried beneath the Permian and Mesozoic cover.

A point is now reached in geological time when with one or two minor exceptions the stratigraphical record ceases and little further information from this source is available. Deposition gives place to erosion and the evidence for the physiographic evolution of the area is henceforward of a fundamentally morphological rather than stratigraphical nature. In place of the data provided by the distribution of the sedimentary rocks and their lithological characters, details must now be sought of the remnants of ancient physiographies. The basis for the method of reconstructing past physiographies lies in the recognition of earlier base levelled erosion surfaces, which may now be partially or heavily dissected by subsequent cycles of erosion. Extensive surfaces partake of the nature of peneplanes and may in general be related to humid, arid, marine or glacial agencies. In the locality with which

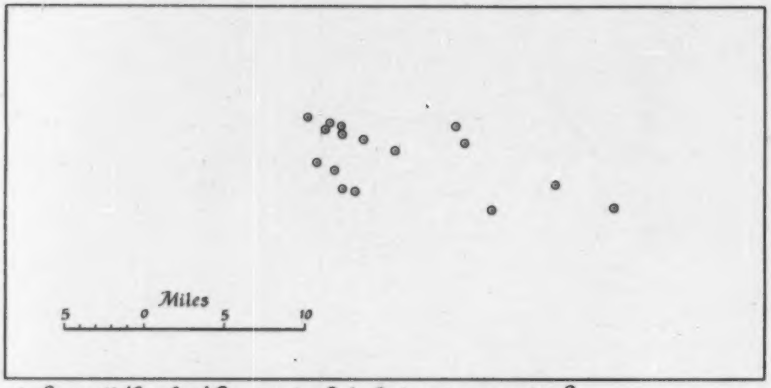
we are concerned two of the agencies can be eliminated on geological grounds. In the first place the local evidence of late Triassic and post Liassic faulting excludes the possibility of relict remnants being preserved *in extenso* of any Permian or Triassic high level pediments (*i.e.* semi-arid erosion surfaces). Secondly, we know from extraneous data that the Exmoor region was outside the main sphere of activity of the Quaternary ice sheets, and this excludes extensive glacial sculpturing.

The geological evidence also enables us to eliminate the possibility of any horizontally disposed strata producing a surface, for as a result of the Hercynian movements the strata have, for the major part, high angles of dip or are intensely folded. The surfaces are found cutting across these highly tilted strata, suggesting a definite planing off of successive rocks. A geological control of topography *within* a cycle may be detected locally: thus the Culm Measure radiolarian charts give the peculiar whale-backed ridges from Godden Hill to South Molton, the Ilfracombe beds are characterized by a minor dip and scarp topography, minor escarpments may be traced in the lowlands eroded in the Triassic deposits, a line of hills near Luccombe are breccia knolls, and Devonian outcrops near Dunster stand out as islands above a plain of red marl. But in all these cases accordance may be found in summit levels, and erosion surfaces may be traced across truncated hill tops. It follows therefore that with the elimination of arid, glacial and structural causes any major erosion surface must be related to a sub-aerial or submarine origin, or possibly a combination of both these agencies.

Erosion surface characteristics

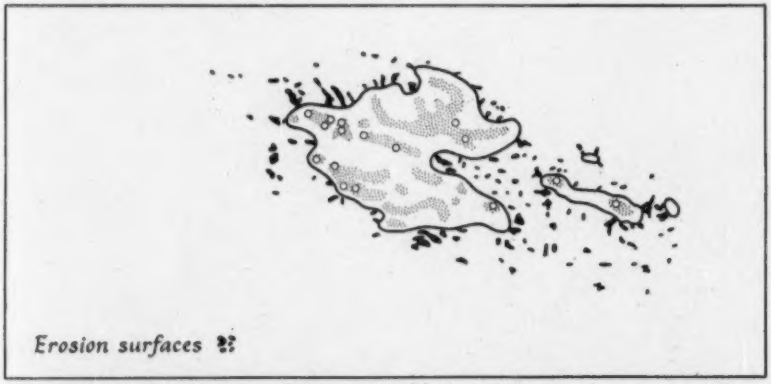
Surfaces corresponding to long periods of stillstand in the base level are locally of a generally level nature. *In extenso* the surfaces however are not "flat" although this is a term which is often used in descriptions. Thus the marine formed surface will normally be a gently inclined plane rising landwards, studies of platforms of marine abrasion at present in course of denudation revealing slopes of the order of 10–80 feet per mile, flattening seawards. The rear of each marine surface will be terminated at least in places by a steeper rise or bluff marking the position of the old cliff line, and this pattern may be repeated for a succession of surfaces. But with an alteration in base level an emergent marine surface becomes subject to sub-aerial erosion and soon begins to lose its characteristics as a result of progressive river dissection. Evidence of the former existence of the marine erosion surface may still however exist in the shape of flat-topped hills and interfluves separating more or less sharp angular V shaped valleys. A marked acceleration in the rate of change of slope on the interfluve will terminate the surface, and the bluff may denote the position of the old cliff line. Where there has been no warping, successive interfluves may reveal bluffs at correlative heights, and providing the features are unrelated to geological or lithological facts, the old cliff line of base level may be traceable for long distances over the face of the country.

The sub-aerial surface on the other hand is not quite so simple. Even in the stage of old age a great variety of forms will be possible in the morphology, and we may find a rolling relief with an amplitude of perhaps 100–150 feet.

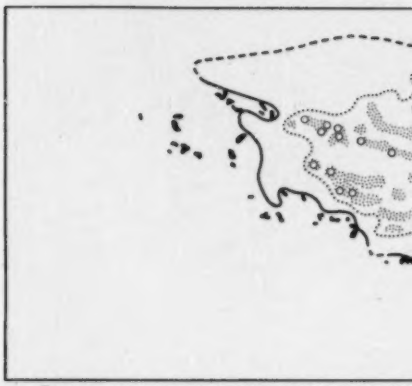


1 Summit 'Surface' Remnants. Sub-Cretaceous peneplain?

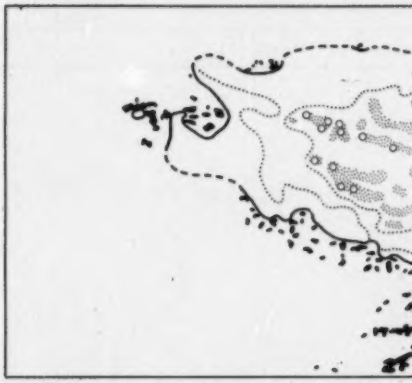
2 Exmoor Surface. Early Tertiary sub-aerial peneplain.



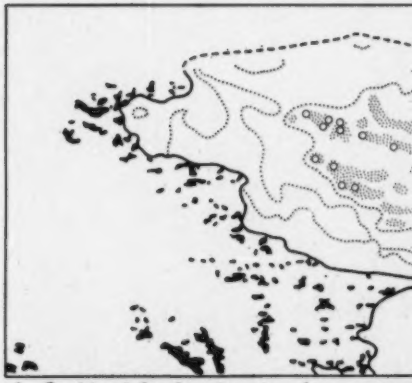
3 Lynton Surface Coastline (approx. 1225ft). Late Miocene submarine peneplain.



4 Molland Surface Coastline (approx. 925ft)

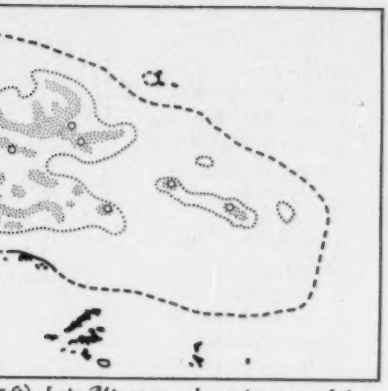


5 Anstey Surface Coastline (approx. 825f

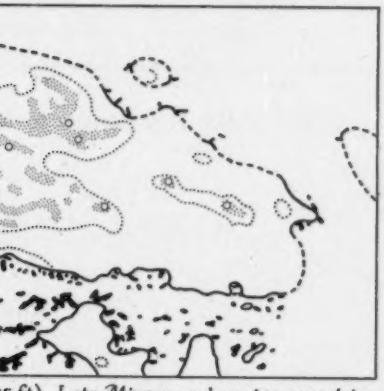


6 Buckland Surface Coastline (approx. 675

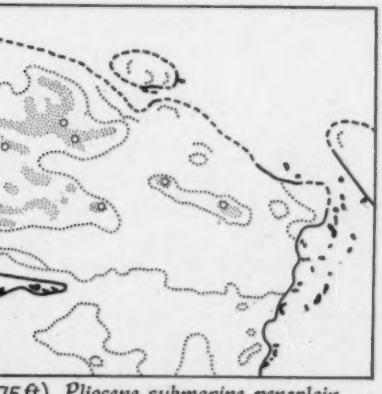
Fig. 3 Stages in the E



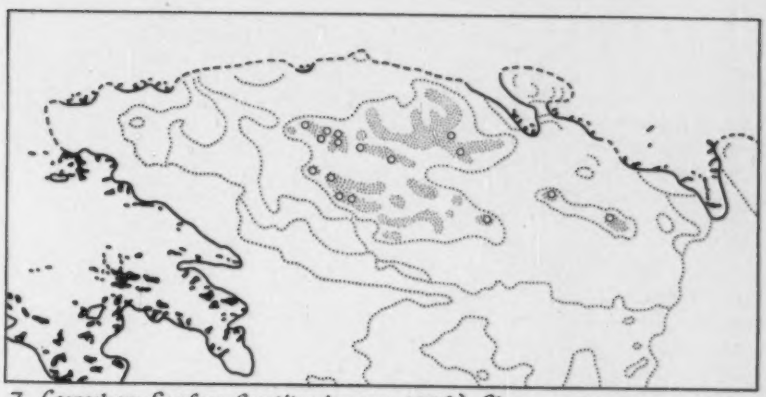
5ft). Late Miocene submarine peneplain.



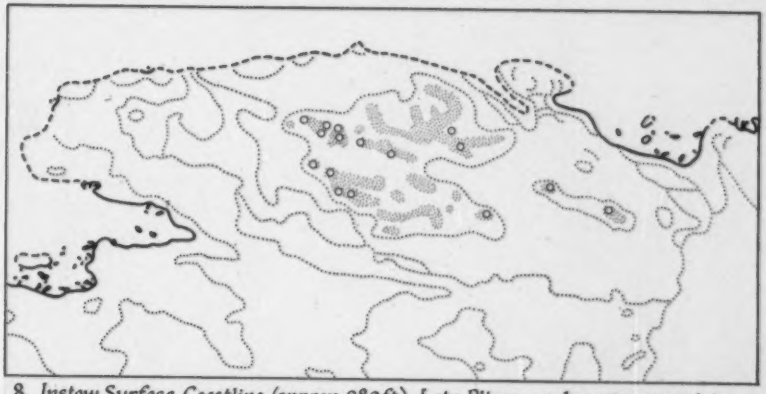
5ft). Late Miocene submarine peneplain.



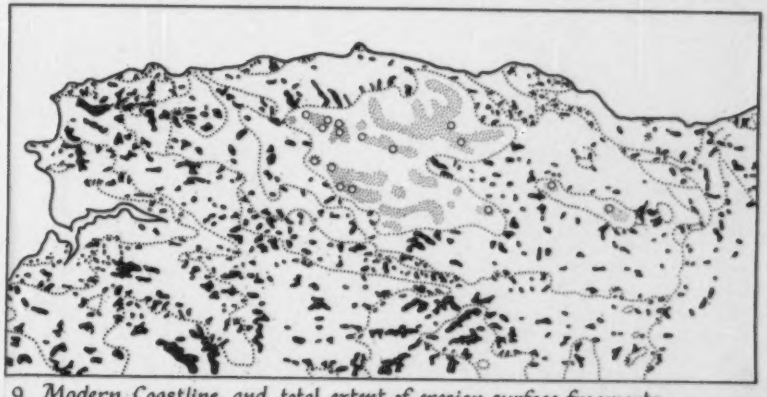
75ft). Pliocene submarine peneplain.



7 Georgeham Surface Coastline (approx. 425ft). Pliocene submarine peneplain.



8 Instow Surface Coastline (approx. 280ft.). Late Pliocene submarine peneplain.



9 Modern Coastline, and total extent of erosion surface fragments.

a Sand
b Fremington clay
c Lias (clays & limestones)
d Trias (sandstones & marls)
e Permian (sandstones & marls)
f Upper Culm measures
g Lower Culm measures

Upper Devonian

h Pilton beds
i Baggy beds
j Pickwell Down beds

Middle Devonian

k Morte slates
l Ilfracombe beds

Lower Devonian

m Hangman grits
n Lynton slates
o Foreland grits

Fig. 1 G

Fig. 2 Altimetric Distribution M

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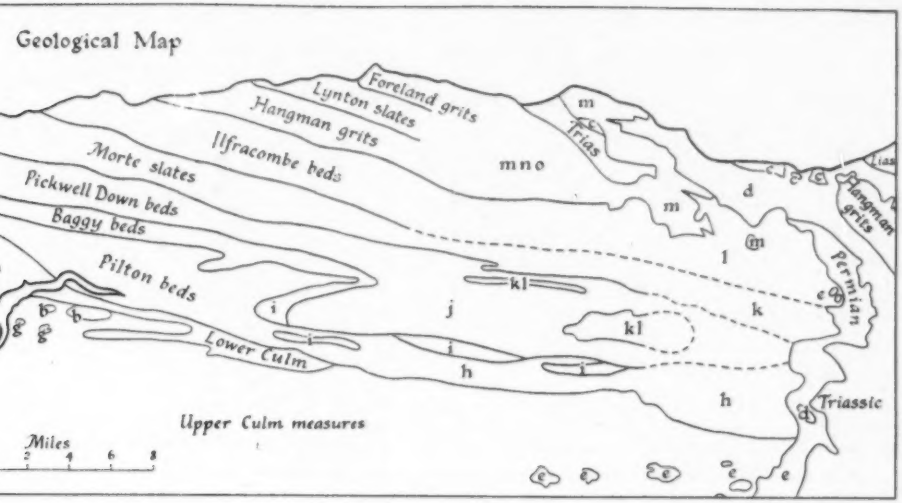
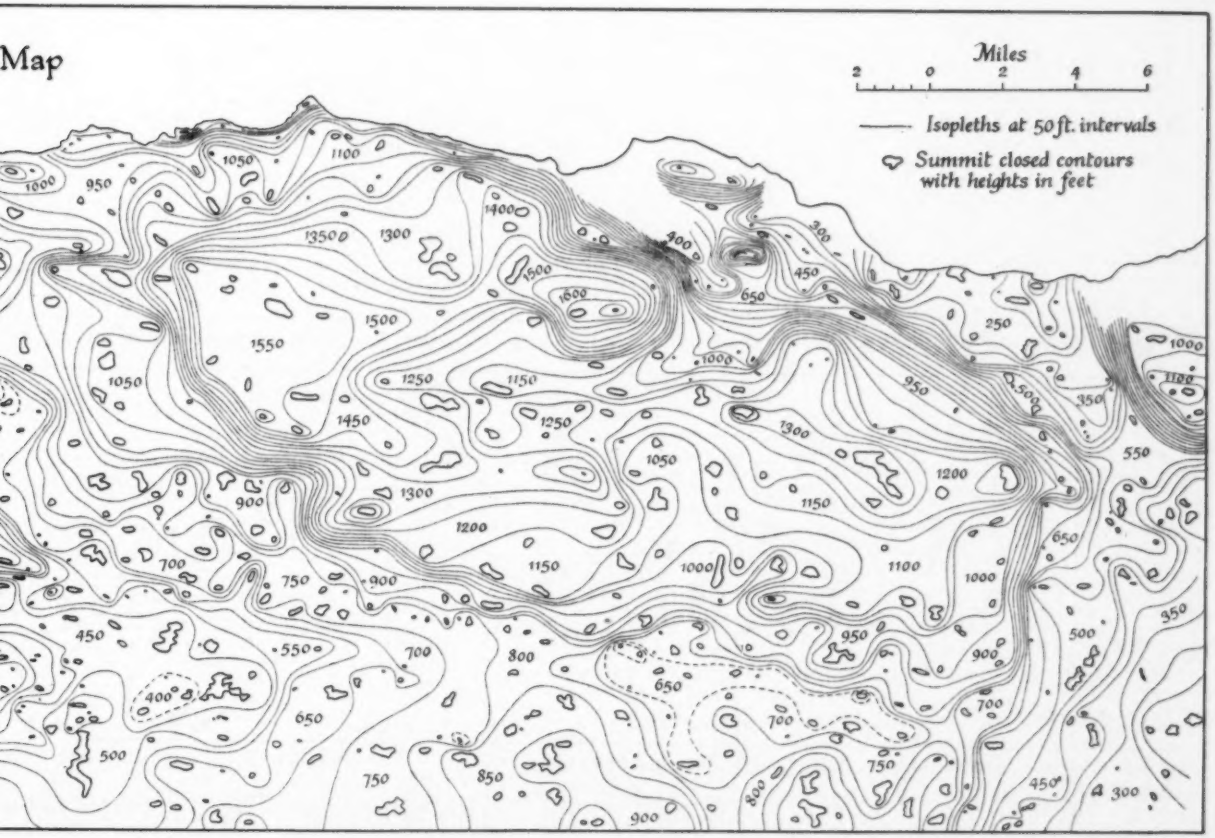

Geological Map
Foreland grits
Lynton slates
Hangman grits
Ilfracombe beds
Morte slates
Pickwell Down beds
Baggy beds
Pilton beds
Lower Culm
Upper Culm measures
Trias
Hangman grits
Permian
Triassic
mno
Miles
2 4 6 8


Map
Miles
2 0 2 4 6
Isopleths at 50 ft. intervals
Summit closed contours with heights in feet

Balchin

Hence, when dissected by later erosion related to lower base levels, extensive flat surfaces may not exist, but rather a general accordance in the height of summit levels with rejuvenated polycyclic valleys. The separation of sub-aerial surfaces may be more difficult than with marine surfaces for there will be no convenient cliff line remnants. These are, in brief, the general principles which must be borne in mind when endeavouring to identify traces of former base levelling processes. But in advanced stages of dissection, identification in the field is not easy or reliable owing to human limitations. The observer's range of visibility is strictly limited and he may only be able to consider a very small proportion of his area at any one time. The appreciation of degrees of slope is also an art which can only be acquired with long practice unless laborious instrumental methods be employed—thus a slope of 1 degree, which might well appear dead flat, actually produces a height difference of some 90 feet a mile. Field evidence may often prove to be deceptive—an apparent peneplaned surface on the horizon may be nothing more than a crest line, whilst a fortuitous merging of hills may produce an apparent accordance of summit levels.

Cartographic analysis of the relief

Assistance in the problem of identification, and also a valuable preliminary to field work, is however provided by a cartographic analysis of the relief. A variety of methods have been proposed in recent years and several of these have been employed in the present investigation. Apart from the limitations of space a complete presentation of all the methods is uncalled for as much of this work can only be regarded as preliminary to field work: in addition the technique is now much more widely known than a few years ago. Superimposed profiles of the Exmoor region were first drawn in a variety of directions and these immediately revealed the multi-cyclic character of the area. Experiments were next made with projected profiles constructed by the original Barrell method. This method is particularly well adapted to show marine planations where these rise in step-like formation inland: the trial projected profiles clearly revealed this tendency along the northern and western edges of Exmoor. Consideration was next given to the possibility of employing hypsographic and clinographic curves, but in view of the uncertainties involved in these methods (S. E. Hollingworth, 1938) and the highly dissected nature of the topography, it was considered doubtful whether the production of the curves would be commensurate with the great expenditure of time involved in their construction. An analysis by the altimetric frequency method had already appeared, since the area of the inquiry was included by Hollingworth in his altimetric analysis of Devon and Cornwall (1938). In this analysis the general curve can be seen to agree fairly closely with known surfaces already established elsewhere in Devon and Cornwall, but there are many additional maxima and minima to consider.

The chief disadvantage of the altimetric method is perhaps the fact that it takes no account of, and gives no indication of, the distribution or areal extent of the summit levels. This information is vital when determining whether a surface is of submarine or sub-aerial origin. In an attempt to overcome this deficiency a further method was tried which might be termed

"an Altimetric Distribution Map." This does not yet figure in morphological literature as a systematic method of relief analysis although there is some resemblance to the generalized contours proposed by S. W. Wooldridge and to maps prepared by A. A. Miller and W. Storrs Cole. In this new method summit heights are traced from the maps covering the region and an isopleth map is mechanically constructed to show their distribution (Fig. 2). Since many summits are not spot-heighted on the 1-inch maps it was decided to take the uppermost closed contour in each case. This is actually more helpful than the bare spot-height because an indication is also given of the nature and extent of the hilltop—whether summit, ridge or "flat."

The preparation of a map of this kind is to a large extent objective, although occasionally alternative representations of the isopleths may arise. In a region of fairly advanced dissection of relief it immediately brings out from the jumble of topography not only the main summit heights but also their distribution and extent. And it is perhaps most effective for revealing the possibilities of a series of coastal marine platforms in an area. Were such a series to exist we might expect to find a stairway, the surfaces being marked on the altimetric distribution map by an opening out of the isopleths, whilst the separating bluffs might be indicated by a closing together of the isopleths. The projected and superimposed profiles indicated a series of "steps" from the coast towards the interior, and this same tendency was at once apparent from the isopleth map of the summit heights.

This analysis cannot of course be said to prove anything, but it is of great value in rapidly locating those areas which merit detailed field attention. The key to differentiation of marine surfaces is either the close juxtaposition of two plateau-like surfaces at markedly different levels, or the actual location on the ground of correlative remnants of the old cliff line. The altimetric distribution map points to the possible location of both. Finally, in view of the deductions to be drawn from the altimetric analysis, more detailed attention was given to the interfluves, and a series of sections were drawn along the majority in search of breaks of slope which might be significant. The doubtful location of the interpolated contours reduces the accuracy of this approach, but additional familiarity with the physiography is gained and further places may be listed for more careful examination in the field.

THE EROSION SURFACES

The next step after a preliminary laboratory investigation of the relief was a detailed examination of the area in the field. For this purpose very effective use was made of the Ordnance Survey's 1/25,000 War Issue maps. These maps were photo-reduced from the 6-inch scale so that there was available for reference in the field a greatly increased number of spot heights and bench marks without the inconvenience of handling nearly two hundred separate sheets. With these the area was carefully worked over, the 1/25,000 maps being used as a base on which to record the erosion surfaces and other relevant data. Particular attention was paid to the interfluves for breaks of slope and to those localities where the cartographic analysis had shown that a distinction between successive surfaces might be drawn. The individual

1/25,000 map frequently revealed no significant pattern owing to the heavy dissection which had taken place but when the morphological data is reduced to the 1-inch scale certain levels are seen to occur persistently, whilst breaks of slope at somewhat similar altitudes emerge and are traceable from one interfluve to the next over wide areas. In the majority of cases these breaks of slope bear no relation to the underlying geology. With the systematic staircase morphology thus revealed over such a large area there seems no feasible alternative [1] to an interpretation which treats the "treads" as marine-formed surfaces and the "rises" as the remnants of now much degraded cliffs, and relating both to a succession of lowered base levels eustatically controlled. In only one case is a true sub-aerial surface postulated, although of course it will be readily understood that sub-aerial activity has since greatly modified the ancient marine surfaces (Fig. 3). The phases noticed can now be systematically examined.

The summit levels

The impression of a summit peneplain is most striking, but a general traverse of the upper hill ranges reveals a far from flat surface. Nevertheless the profiles and silhouettes with which we are continually faced suggest either that a general accordance of summit levels has been reached in the late stage of a sub-aerial cycle, or that the existing landscape immediately adjacent to the summit areas has been produced by the dissection of perhaps a marine surface, few if any traces of which now remain. Examination of the major summits reveals four main groupings. In the west near Challacombe there is a remarkable collection of at least ten summits which all reach heights between 1550 and 1618 feet. Some 10 miles east-south-east is another major grouping in the neighbourhood of Dunkery Beacon, in which several summits reach about 1525 feet, but above these Dunkery itself rises to 1706 feet. Continuing south-eastwards for another 10 miles the Brendon Hills are observed to rise to summits of 1344 and 1391 feet, whilst some 15 miles farther south-east still the Quantocks rise to 1171 and 1281 feet. So, excluding the anomalous case of Dunkery Beacon, we have a steady and progressive decline in summit heights in a general east-south-east direction. The rate of fall is actually very slight and in the field is quite imperceptible to the eye over such great distances—over the full 35 miles the difference is some 350 feet giving a "slope" of less than 7 minutes of a degree.

Despite the anomaly of Dunkery Beacon, which rises slightly above this gentle east-south-east incline, the rough fit of the other groupings into the sequence of summit levels strongly suggests that the upper accordance of levels has been achieved by the dissection of a marine surface rather than fortuitously produced by mature sub-aerial denudation. In relation to the chronology of the denudation, there is reason to suppose that these summit levels may represent fragments of a sub-Cretaceous marine peneplane.

[1] In common with most geomorphologists the present writer does not subscribe to the Walter Penck concept of piedmont treppen. But it should be noted here that if this were the normal process a somewhat different sub-aerial topography would result with a stepped morphology not easily distinguishable in the advanced stages from dissected marine cut shelves.

The Exmoor Surface

Below the summit "surface" and comprising the greater part of the Exmoor region proper is a sub-aerially dissected upland region which has clearly been subject to rejuvenation; fairly deeply incised valleys are found cutting back into a sub-mature rolling topography. The latter is usually characteristic between heights ranging from 1600 to 1250 feet; below the latter elevation slopes steepen and are clearly related to a different base level. This surface, which forms the greater part of the moorland area, exists in fairly compact blocks. From Culbone Hill in the north it stretches south to Aldermans Barrow, where an easterly extension embraces Dunkery Beacon and a westerly arm reaches out to Brendon Common and Exe Plain. Farther west, but separated by rejuvenated valleys from this area, is the locality known as The Chains: this and much of Challacombe Common is also part of the surface.

Further extensions occur south of the River Barle incision, and the upper parts of Hangley Cleave, North Molton Ridge, Withypool Common and Winsford Hill are also parts of the Exmoor Surface. The upper portions of the Brendon Hills may also be assigned to this surface but these now exist as detached units as a result of later marine transgressions. It should be emphasized that unlike the marine surfaces described below, the Exmoor Surface has no systematic slope from a higher to a lower bluff line; it is quite clearly a series of broad summits away from which sub-mature slopes stretch in all directions until the sides of deeply incised valleys are reached. Geologically, parts of the lower, middle and upper Devonian all outcrop on the surface, but apart from the restriction to the Devonian there appears to be no geological correlation.

The Lynton Surface

This surface, which is particularly well developed along the north coast in the Lynton district, has been well preserved on the interfluves. A careful examination on the ground revealed an upper break of slope in many localities at an average height of about 1225 feet. This feature can be traced on successive interfluves right round the central region. Above the break of slope the land flattens out again and we find fragments of the Exmoor Surface; below, the interfluves slope gently down to 1050 and 1000 feet in the majority of cases. Below the latter height there is usually a relatively steep convex slope to lower levels. When the isolated fragments are collected on a general map the pattern which emerges is that of a "shelf" some 2 to 3 miles wide fringing the central area, into which it appears to have been cut. The slope of the shelf is of the order of 1 degree. Within this belt of territory no summits rise above the gentle slope, although of course some summits may be found below the general level as a result of denudation. These facts strongly suggest a marine erosion surface.

In addition to the Lynton area the platform is also present at Blackmoor Gate, extending south, and although the ancient cliff line is much more difficult to trace as a result of later sub-aerial dissection, it is clear that the flat-topped Rowley Down and Brafton Down together with Mockham Down are to be associated with the Lynton Surface. Near Mockham Down an

easterly trend develops and a little farther on at Yard Down there occurs one of the more spectacular remnants of the shelf and associated bluff. Continuing eastwards, remains are more fragmentary until Molland Common is reached; this with Moorhouse Ridge and Anstey Common forms another conspicuous portion of the platform. The upper break of slope seems absent however owing to dissection by the Danes Brook and the River Barle. On looking east from Anstey Common the most extensive portion of the Lynton Surface comes into view—the area south of the Brendon Hills. Further fragmentary remains occur south of Dunkery Beacon and west of Exford, where there is a suggestion of a considerable embayment, which somewhat significantly correlates with the Ilfracombe beds.

Traverses along the interfluves, where the Lynton Surface is well preserved, occasionally revealed minor breaks of slope. No correlation of these breaks seems possible at present and in the light of the conclusions subsequently offered they must presumably be ascribed to minor local cliffing on the retreat of the sea from the Lynton level. Geologically the Lynton Surface is confined to the Devonian rocks but it may be found cutting across upper, middle and lower divisions. The trend of the Lynton coastline and the geological boundaries reveal no general correlation when examined together, the former runs across the latter indiscriminately and this again confirms the suggested marine origin of the surface.

The Molland Surface

The next platform below the Lynton Surface, well shown near Molland, occurs within a narrower height range as it is found between 850 feet and about 925 feet. At the latter height there is a recurrent break of slope followed by a rapid rise to the Lynton Surface. Near 850 feet, the approximate lower termination of the Molland Surface, there is either a gradual mergence into the next lower platform (the Anstey) or a more accentuated drop to the level below the Anstey (the Buckland). When the isolated fragments of the Molland Surface are plotted, the distribution is seen to resemble in part that of the Lynton Surface. A relatively narrow fringing shelf again emerges, being especially well marked along the south-western edge of Exmoor near Molland and Heasley. It continues northwards to [illegible]s Arlington where the fragments indicate an originally much wider plat[illegible] stretching from Wistlandpound (where the break of slope is well shown) westwards to Berry Down: beyond is a small "outlier" at Hore Down Gate. South of Combe Martin erosion at the next lower level seems to have removed much of the Molland Surface but fragments occur in the neighbourhood of Parracombe.

The remaining parts of the Molland Surface are detached from this continuous fringing shelf and are largely isolated fragments. Marked breaks of slope at about 925 feet with fronting flats occur on Selworthy Beacon, whilst to the south of Exmoor the great flat uplands of Rackenford Moor, Beaples Moor and White Moor, together with the upland area near Huntsham, all fall within the height range of the Molland Surface. The distribution of the Molland Surface considered in relation to the geology again reveals diversity as it occurs in the Ilfracombe, Morte and Pickwell Down beds of the Devonian as well as in the Culm Measures. Once again the trend of the associated

coastline is seen to cut indiscriminately across the geological boundaries. But the Molland Surface, though largely confined to the western part of Exmoor, is certainly mainly preserved in the more resistant Morte slates and Pickwell Down beds, which it would seem have held up the erosion of lower base levelling agencies.

The Anstey Surface

This is terminated upwards by a break of slope which comes at approximately 825 feet. This break of slope may not be conspicuous—it is actually the juxtaposition with the Lynton Surface which reveals the break most effectively. From this upper level the interfluves slope gently down to a 750-foot or 700-foot height below which there is again a more rapid drop to lower levels. The most spectacular development of the surface is perhaps seen west of Anstey. Here, separated by deeply incised valleys cut by streams coming from Exmoor, there is a succession of flat-topped hills and interfluves fronting the Yeo valley at remarkably accordant levels. These accordant levels continue westwards to North Molton, thence north-westwards to Stoke Rivers where the Anstey Surface abruptly ends as a result of an incursion of the next lower surface. However, it reappears in the neighbourhood of Bittadon and is conspicuous below the Molland outlier at Hore Down Gate.

Whilst the modern coastline in the north is for the greater part in juxtaposition with the Lynton Surface, there are several isolated localities with marked flats within the Anstey range and backed by breaks of slope at about 825 feet. These would appear to be fragments of the Anstey Surface. The localities are at Trentishoe Down, Martinhoe, The Foreland, Selworthy Beacon, North Hill, and also south of West Quantoxhead. The fragments described so far resemble the previous cases, *i.e.* form a fringing shelf of limited width around the main central upland area; but there exists in the southern half of the region near Rackenford Moor, Beaples Moor and near Bampton, a more extensive area in which the summit and interfluve heights all fall within the Anstey range. Geologically we again note that the surface truncates all divisions of the Devonian and Culm Measures in which it occurs. Coastline trends also cut across the geological boundaries. The evidence of the physiography, distribution characteristics and geology hence all points to a marine origin for this surface.

The Buckland Surface

The next step has its upper limit at about 675 feet and a slightly wider height range as it may fall gently to below 500 feet. The Buckland Surface dominates the upland area to the south of Ilfracombe and to the immediate east of Woolacombe and it may be traced south-eastward through West Down and Marwood to the neighbourhood of Shirwell. Here the break of slope at 675 feet is more conspicuous as the platform abuts against the Molland Surface, the rise to Garman's Down forming a marked physiographic feature. A little to the east there is however the even more accentuated feature at Bratton Fleming, where there is a rise of 400 feet from the Buckland Surface to the Lynton Surface in less than three-quarters of a mile: erosion

at the Buckland level has here removed all traces of the Molland and Anstey surfaces. But southwards these latter surfaces reappear, and the Buckland Surface begins to parallel the trend of the Anstey Surface.

So far the Buckland Surface resembles previous fringing shelves but now, to the south, there is an area where there seems to have been a much more extensive development of this particular surface. Although fairly well dissected there remain many extensive flat-topped summits which fall within the Buckland height range and it is significant that the very resistant radiolarian cherts eastward from Codden Hill are all truncated at this level. Much of the more subdued topography near South Molton (Plate 1) and elongated flat-topped ridges near Chittlehamholt and Kingsnympton may also be related to this level. In some extensive stretches westward across the River Taw valley, the high ground of Beara Moor, High Bickington and Alverdiscott similarly continues the Buckland Surface. Eastward the surface is terminated by the rise to the Anstey level, but when the fragments are plotted we note that there is a prolonged extension of the coastal trend-line up the River Yeo valley which is highly suggestive of a marine incursion in an already existing valley.

Towards the eastern extremities of the area under discussion, further evidence of a planation within the height range of the Buckland Surface is provided by the remarkable accordance of summit levels in the Permian and Triassic country from Lydeard St. Lawrance southwards, through Milverton to Holcombe Rogus. Whilst actual cliff remnants are not readily seen, the surface is outstanding as it is for a considerable distance in close juxtaposition with the Lynton Surface of both the Brendon Hills and Quantocks. The relation of this surface to the geology shows even greater diversity than hitherto observed, for traces of it may be found throughout the upper and middle Devonian, upper and lower Culm Measures and also in the Triassic and Permian. As might be expected the fragments are more extensive in the Devonian and Carboniferous slates and shales than in the Permian and Triassic marls and sandstones: the existence of the level over such a wide area and through so many diverse formations coupled with the trend of the associated "coastline" is striking testimony to the marine origin of the Buckland Surface.

The Georgeham Surface

This surface, extending from about 425 feet to 300 feet, is evidently a continuation of the so-called "430-foot platform" which has already been traced in many parts of Devon and Cornwall. In the area now being considered, additional features of this episode may be found although the remains are more discontinuous than farther south in Cornwall. The Georgeham locality is characterized by a platform at this level with a marked break of slope at the foot of Pickwell Down denoting the old cliff line. South-eastward the surface may be traced in the summit levels around Braunton and Barnstaple: correlative features are also noticeable near Swimbridge, and this indentation is suggestive of a marine transgression of a river valley. Hangman's Hill and Codden Hill in the radiolarian cherts reveal marked cliffing at this level; south-eastward are many interfluve and summit levels within the

height range, but the break of slope is not conspicuous again until beyond the Taw valley, where the high ground forming the Buckland Surface is reached. The whole of the area between Bideford and Torrington is dominated by the Georgeham Surface, Torrington itself being built upon part of the platform.

Further traces of the surface exist in the Vale of Stogumber. To the east the foot of the Quantocks carries unmistakable fragments complete with a break of slope, here more conspicuous as the rise is to the Lynton Surface. The centre of the Vale has summit levels and ridges falling within the Georgeham height range whilst to the west we may trace fragmentary remains of the platform along the foot of the Brendon Hills and Croydon Hill right to Dunster. Beyond Dunster the associated bluff is again a prominent feature. The surface is also in evidence in the Vale of Porlock where traces of the bluff may be found in the more resistant Devonian rocks, whilst the breccia knolls near Luccombe are also truncated at this level. A fragment is preserved near Lynton with a more extensive development along the coast from Combe Martin to Morte Point. Both the bluff and the platform here form a noticeable shelf in the coastal physiography. The distribution of this surface with reference to the geology again shows a marked truncation of Devonian, Carboniferous, Permian and Triassic rocks. The break of slope bluff is however confined to the harder shales and slates of the Devonian and Carboniferous. Once again there can be little doubt that we have evidence of an extensive marine phase.

The Instow Surface

Finally, in the long succession of steps which it has been possible to decipher from the centre of Exmoor down to the coast, there is the Instow Surface. A great deal of this platform is not now in existence, but it is in evidence in the Instow–Bideford district (Plate 2) where a break of slope may be distinguished at about 280 feet away from which interfluve and summit heights slope gently down to 200 feet or slightly below. In the absence of any further step below the Instow level (apart from the present platform of marine denudation) it is difficult to fix a precise lower limit to this phase. Traces of it exist in the neighbourhood of Barnstaple and Braunton (where the break of slope is well shown) and there are small traces along the north coast at Morthoe Point and Widmouth Head, but the Instow Surface is not again evident until the Vale of Williton is reached. Here a series of relatively flat-topped summits fall within the height range, whilst the appropriate break of slope may be traced in two localities at the foot of the Quantocks and the Brendon Hills. It would seem that erosion at the modern level has largely removed much of the Instow Surface, which even at its maximum development was probably much less extensive as a surface than any of the higher platforms which have been described.

Evidence from the superficial deposits

Despite the apparent marine origin of the majority of the surfaces which it has been possible to notice, there seems to be an almost complete absence of any clearly correlative marine deposits. The 6-inch maps occasionally show "old gravel pits" or "old sand pits" within the area, and there are also

some references in the geological literature to possible sites. Altogether nearly thirty potential places were examined but in the majority of cases the descriptions are either misleading or the exposures have disappeared. Excluding some deposits mapped by the Geological Survey as Permian, but which may prove to be resorted Tertiary deposits, attention will now be confined to the "positive" sites, of which there are three of importance.

Of these the Orleigh Court deposit, which rests on the Georgeham Surface, is perhaps the most interesting. This consists of a superficial sand and flint cover stretching from Orleigh Mill to Yeo Bridge (near Bideford). It extends for about three quarters of a mile in a north-west to north-east direction and is about a quarter of a mile in width. H. Dewey, in the Geological Survey's Regional Handbook, describes the deposit as an outlier of Greensand—"the most westerly limit of the Cretaceous." But Dewey appears to have overlooked a paper by Inkermann Rogers and Brian Simpson (1937), which gives a petrological analysis of the deposit, and his opinion seems to echo the early suggestion made by de la Beche in his classical report (pp. 236, 249 and 410). A later opinion was given by W. A. E. Ussher (1879), who suggested that the deposit was probably a "re-assorted Cretaceous material, perhaps a Tertiary gravel," rather than Greensand in situ. P. G. H. Boswell (1923) ascribed the deposit to the Eocene but Milner in the discussion of this paper favoured a Pliocene age. Rogers and Simpson considered that it must be a derived deposit of at least post-Eocene age and that it was probably laid down on part of the 400-foot platform, and hence of Pliocene age.

It is very significant that the deposit extends up to the 400-foot contour but not above it, and it is very near the trend line of the Georgeham bluff. This flint gravel appears to have been originally a beach deposit analogous to the flint gravel beaches which occur at the modern sea-level in Padstow Bay, Mount's Bay and Gunwalloe. Secondly, there is the Fremington Clay. There are three areas of this clay near Fremington underlain by a gravel and lying within an old infilled valley. The deposit was originally fully described and mapped by G. Maw in 1864, who, whilst postulating alternative explanations, was inclined to favour the idea of a boulder clay, largely on account of an included boulder near the surface of the deposit. Dewey, in the Regional Handbook, follows Maw and calls the clay a "true boulder clay."

However, the great thickness of this homogeneous clay (78 feet), its position and the fact that it is free from grit and shells, hardly supports a glacial origin. An alluvial infilling of an old river valley seems a much more logical explanation, although if this be accepted we are still left with the problem of the included boulder, together with one or two surface boulders which have been noted more recently. The height of the top of the clay and the superficial boulders is however such that the boulders could be glacial erratics stranded by icebergs—definite examples of which occur in Croyde Bay.

It is also significant that the general west–east direction of the old valley is continued by the indentation already observed for the Georgeham surface, and thence eastward by a marked physiographic feature at the foot of Exmoor, which is now only partly occupied by rivers. This suggests the possibility of, at some time, a fairly large river, perhaps rising on the Triassic deposits to the east since the clay strongly resembles a reworked Keuper Marl. The third

1. Break of slope from the Buckland to the Anstey surface. North of South Molton

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deposit of interest lies near Filleigh, east of Barnstaple, where there are old clay pits once used by a local brick and tile works. Local exposures reveal a fine bluish clay very similar to the Fremington Deposit. As the Filleigh clay occupies a dry col position on the line of the ancient valley which extends eastwards from Fremington, there would seem strong grounds for associating both the Fremington and Filleigh clays in a somewhat similar origin.

Evidence from the river valleys

Trial longitudinal profiles for most of the rivers were constructed from the Ordnance Survey maps during the cartographic analysis. Most profiles clearly reveal a polycyclic tendency, but the limitations imposed by the contour interval will not permit any accurate estimations of the heights of former base levels to be made. Transverse profiles are of little assistance. The great majority of the rivers exhibit a youthful appearance with steep valley sides; valley-in-valley conditions are by no means uncommon but more than two phases can rarely be distinguished in any one locality. The state of dissection is insufficiently mature for river terraces to have developed at all extensively.

The drainage pattern exhibits some interesting although frequently anomalous features. Whilst the shorter rivers tend to radiate off the high ground of Exmoor and in many places suggest an extended consequent type related to successive lowerings of the base level, they frequently proceed across the emergent platform at an acute angle to the abandoned coastline. This tendency has however been noticed elsewhere in Devon and Cornwall (Balchin, 1937) and the simple theoretical morphological concept may not always apply to these relatively narrow marine shelves.

The larger rivers also follow courses which are somewhat puzzling. The sources of the Torridge, for example, are found only 2 or 3 miles from the coast near Clovelly, but the river flows south-east towards Hatherleigh and then north to Torrington and Bideford, some 50 miles, before reaching the sea. The Bray has a southerly direction which continues at its junction with the Yeo, but when the Taw is reached the direction suddenly changes to the north-west. The Barle and the Exe flow south-eastward until their junction near Dulverton beyond which the river runs into a further gorge-like valley sweeping through the Culm hills in a great curve towards the east; but at the junction with the tributary Batherm, the direction suddenly changes to the south. It has already been noted that certain of the marine surfaces can be traced along existing valleys. This evidence and these anomalous courses point to the existence of a sub-aerial topography before the formation of the platforms.

The same conclusion must also be drawn from a study of the conspicuous physiographic feature which stretches in an east–west direction between the main Exmoor mass and the uplands of the south. This is generally followed by the line of the West Region railway. When viewed from near Anstey it appears as a great wide open valley dropping to the west. Parts only are now occupied by west-flowing streams; in other places easterly flowing rivers occupy the feature, but remnants of the old valley are seen to exist in a series of flat-floored and poorly drained cols which drop in height westward. These are at East Anstey 710 feet, Whitechapel Moors 425 feet, Johnstone Moors

2. South of Bideford. Instow surface in immediate foreground, then the Georgeham and Buckland levels
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420 feet, Hache Moor 410 feet, West Ford 400 feet, Leary Moors 370 feet, Swimbridge 225 feet and Landkey 185 feet. The trend of this ancient valley also seems to continue to the west through the cols at Morebath, Petton and Venn Cross, but these must have been lowered in height for the altitudes are now slightly less than at East Anstey.

This ancient valley further carries clear evidence of both the Buckland and Georgeham surfaces: there must hence have been incursions into an already existing valley in both these cases. Furthermore the trend of this ancient valley runs on, as we have seen, into the abandoned valley now infilled with Fremington Clay. A major feature of the drainage pattern within the region of the Exmoor Surface and to some extent of the Lynton Surface is a tendency for the rivers to flow south-eastwards. This is in line with the general fall traced in the Summit Surface and suggests the possibility of superimposition. This is further supported by the clear cases of entrenched meanders of the Barle and Exe, near Dulverton and Exton, which completely ignore the local geology. Moreover this superimposition must have preceded the etching of the Lynton Surface, in which the entrenched meanders occur, since no surface cover of deposits is associated with the Lynton phase. Later lowering of the base level is reflected in some remarkable high level abandoned meander cores; as, for example, at Hinam.

The extent to which the drainage pattern has become adjusted to structure frequently provides information on the physiographic history of an area, and this aspect was considered in detail. The main conclusions which emerge are that there appears to be little or no sign of adjustment in the area of the Foreland grits, Lynton slates and Hangman grits. Nor on the Pickwell Down beds and Pilton beds, where in all cases the streams run across the strike direction. Some adjustment appears to have occurred on the Ilfracombe beds, the most conspicuous cases being the upper waters of the Exe and Barle. The same tendency is also seen on the Morte slates, again with the Exe and Barle and some of their tributaries. On the other hand the Baggy beds of the upper Devonian, although only outcropping in a relatively narrow band, appear to contain in the west quite a number of streams running parallel to the strike, although these beds stand out as resistant on the coast. One can safely say therefore that there is little evidence of any extensive adjustment of drainage to structure with the greater part of the system which is found on the Devonian rocks. But the junction of the Devonian and Carboniferous frequently follows a valley line, and on the Culm Measures there is perhaps a little more evidence of adjustment. On the New Red rocks to the east, faulting seems to have greatly influenced the drainage pattern.

After a detailed inspection one is left with the general impression that there has been little subsequent development or adjustment to structure on the more resistant Devonian, except in the higher regions which have been exposed longest and are traversed by larger rivers such as the Barle and Exe. At lower levels much of the drainage is doubtless of an extended consequent type related to the emergence of the platforms. Whilst the Culm Measures show more traces of adjustment to structure it would, in many cases, be difficult to say whether such adjustment took place before or after the marine transgressions.

The denudation chronology

One early geological episode which has influenced the present morphology was the pre-Triassic faulting which led to the formation of basin-like depressions in which the Triassic conglomerates and red sandstones were laid down. Certain of these faults and other new ones moved some hundreds of feet in late Triassic time and again to a minor extent in post-Liassic time. This produced a block-fault system in the eastern part of the region. Although subsequently buried to a greater or less extent by Mesozoic deposits, this system has influenced dissection during Tertiary time, and locally at least the broad lines of the topography may be regarded as partly exhumed. The faulting has clearly upset and eliminated any Triassic peneplain which may have existed. Evidence from widespread deposits now ceases and the sequence can only be continued by reference to erosional features. It seems clear from the entrenched meanders of the Barle and other rivers that the drainage pattern has, in the higher reaches of certain rivers, been superimposed. This could only have occurred from a Cretaceous cover, for the Palaeozoic rocks are known to have been exposed in Eocene time.[1]

Of the possible Cretaceous cover of Exmoor no trace now remains and we can only point to the so called Summit "Surface" which, with a gentle average slope of 7 minutes of a degree to the east runs approximately into the level at which Cretaceous deposits occur in Southern England. This strongly suggests that in the Summit "Surface" we may have fragmentary traces of a sub-Cretaceous surface presumably of marine origin. With the retreat of the Cretaceous sea from the west, sub-aerial agencies immediately began the task of removing the cover and by mid-Eocene time this appears to have been largely completed. But in the process the river system had in part been let down onto the Palaeozoic rocks. There is reason to suppose that this cycle of sub-aerial erosion extended through the Eocene period into the Oligocene and achieved a fairly advanced stage of maturity, traces of which are now left in the Exmoor Surface, high above the direct influences of the marine transgressions which came later. It may be that the ancient valley which is traceable from Anstey to Bideford is a remnant of this cycle. The Fremington clay and the Filleigh clay would seem to be deposits derived from the gradually disappearing mantle of Triassic rocks to the east: they are perhaps of Oligocene date and related to a change of base level. Further detailed work on these clays in relation to the Bovey Tracey and Petrockstow clays would perhaps give a firm answer to this interesting problem.

The topography of the Early Tertiary sub-aerial cycle was next to be modified by two agencies. In the first place there now seems agreement (S. E. Hollingworth, 1938) that the late Oligocene and early Miocene folding associated with the Alpine orogeny extended to some degree into Devon and

[1] J. F. N. Green (1949) in dealing with the history of the River Dart put forward a somewhat similar morphological suggestion but proposes an Eocene planation with a cover of Eocene sediments. His theoretical reconstruction for Dartmoor does not however appear to fit into the known characteristics of the Eocene deposits of Southern England. These become coarser and more gravelly as they are traced from Hampshire into Dorset, and both the Reading beds and lower Bagshot sands may be shown to pass westwards into true sub-angular river gravels. The constituents of the gravels clearly indicate the exposure of Palaeozoic and Permian rocks farther west.

Cornwall. Secondly, there is clear evidence of a widespread submergence of the greater part of the area which, as has been seen, is now dominated by a series of platforms or narrow shelves. It is submitted that these, by reason of their distribution and character, can have none other than a marine origin. Since none of the surfaces from the Lynton down to the modern level show any conspicuous signs of warping, the agreed influence of the Alpine movements enables us to fix a limit to the age of the platforms. So it would appear that the submergence of the Early Tertiary sub-aerial cycle reached a maximum in post-Alpine time and that this inundation was responsible for the production of the high level Lynton Surface. Erosion during the transgression partly prepared the physiography for the subsequent series of platforms, and no doubt also removed any remaining traces of the Cretaceous cover together with much of the underlying Permian and Triassic deposits. There now seems to have been a gradual re-emergence of the area punctuated by stillstands of the main base level. An analysis of the breaks of slope confirms this concept. When plotted on a 1-inch map they are seen to fall along definite lines. Reducing to the $^1/_4$-inch scale and extracting each level in turn, the missing parts (which have presumably disappeared through marine erosion at lower levels) can be hypothecated with confidence, and a sequence of logical stages of emergence can be built up as in Figures 3.1–3.9.

With the fall of the sea from the Lynton to the Molland level, the Lynton Surface would emerge as a platform cut in the hard Palaeozoic rocks, the rivers doubtless reoccupying such traces of their old courses as still existed or in cases fashioning new valleys on the emerged platform. This process appears to have been repeated several times as the base level fell and it is possible to distinguish both pre-platform and post-platform valley types. Hence the relatively flat-topped interfluves which rise inland in step-like formation can be explained with comparative ease, but caution must be exercised with the intervening valleys, for there may be several elements involved. Rejuvenation has clearly influenced the great majority of the river courses, as the polycyclic longitudinal and transverse profiles clearly show; but we cannot explain the whole drainage pattern on the basis of extended streams consequent upon the slope of the emergent platforms. Elements of the Early Tertiary sub-aerial surface were apparently not completely erased by the marine transgressions, and this palimpsest of an earlier period has clearly influenced in places certain of the river courses. In some areas this control can be traced back still earlier to superimposition from probably a Cretaceous cover. Other valleys have been formed by ancient coastal waterfalls which have migrated back inland. These facts plus the possibility of oscillations in the lowering of the base level from the Lynton maximum make the unravelling of any one river profile a somewhat complicated task.

Thus a reasonably logical explanation can be given for most features in the morphology, but one major difficulty remains and this is the determination of the respective ages of the marine erosion surfaces. Whilst we can say with some measure of confidence that they are all post-Alpine there is still the enormous span of time represented by the Miocene, Pliocene and Pleistocene in which they might have been formed. Superficial deposits on the surfaces which might provide a clue in the problem of dating are surprisingly few and

far apart: this is one of the major puzzles of most of the erosion surfaces located in western Britain, although it is not difficult to account for their absence from the Exmoor region. A glance at the distribution map of surface remnants shows that there was no large land mass adjacent on which substantial rivers could arise. Further, the material brought down by the minor rivers would tend to fill in the submerged Early Tertiary valleys. The latter deposits would doubtless be removed quickly as rivers re-established their courses with the next lowering of the base level. The investigation of the superficial deposits in the area only revealed one locality where definite information can be had. This is the Orleigh Court flint gravel which by reason of its mineral suite can be correlated with other deposits of Pliocene age. This enables us to place the Georgeham Surface and presumably the next lower, the Instow Surface, in the Pliocene: and this will agree with other evidence from the south-west of England. There is however no purely local evidence available as yet which enables one to date definitely any of the higher surfaces on Exmoor. This at present can only be done by exterior correlation on the assumption of a eustatic hypothesis.

Whilst demonstrating the increasing volume of evidence supporting the hypothesis of post-Alpine eustatic shifts of sea-level, Professor S. W. Wooldridge has drawn attention to the difficulty of dating surfaces in this country in the absence of superficial deposits. Much, if not most, of our dating has been built up on the basis of the St. Erth (Cornwall) and Lenham (Kent) deposits and until more definite information is forthcoming the dating of the upper surfaces must remain an open question. On the continent there is evidence of both a Miocene and a Pliocene transgression. In this country there is clear evidence of a Pliocene transgression up to a height of 675 feet, but no further deposits have yet come to light above this level. Wooldridge inclines to the view that the Pliocene transgression reached up to perhaps 1225 feet in this country, but in working over the Exmoor region the present writer has been much impressed by the change in character which occurs above and below the Buckland coastline—*i.e.* the 675-foot level. It may be that surfaces above this are late Miocene in age, and that the 1225-foot break of slope marks the maximum of a Miocene transgression with perhaps the Buckland 675-foot coastline representing the maximum of Pliocene transgression.

In conclusion I would like to acknowledge my indebtedness to the Central Research Fund of the University of London for financial assistance in the field work, and to my colleagues Professor S. W. Wooldridge and Miss Alice Coleman for much help and many valuable suggestions received during the course of the investigation.

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21/957.223 Bampton
21/560.330 Barnstaple
21/820.216 Beaples Moor
21/570.192 Beara Moor
21/570.435 Berry Down
21/455.265 Bideford
21/545.415 Bittadon
21/646.432 Blackmoor Gate
21/662.388 Brafton Down
21/644.378 Bratton Fleming
21/487.367 Braunton
21/770.450 Brendon Common
31/020.343 Brendon Hill

21/735.425 Chains (The)
21/692.408 Challacombe
21/650.210 Chittlehamholt
31/038.420 Cleeve (Old)
21/318.248 Clovelly
21/582.296 Codden Hill
21/590.460 Combe Martin
21/835.002 Crediton
21/435.392 Croyde Bay
21/980.392 Croydon Hill
21/831.473 Culbone Hill

21/914.279 Dulverton
21/892.417 Dunkery Beacon
21/992.436 Dunster

21/755.420 Exe Plain
31/084.350 Elworthy
21/853.383 Exford
21/926.336 Exton

21/668.280 Filleigh
21/754.512 Foreland Point
21/513.324 Fremington

21/595.395 Garman's Down
21/980.435 Grabbist Hill
21/715.275 Hacche Moor
21/745.365 Hangley Cleave
21/597.297 Hangman's Hill
21/542.043 Hatherleigh
21/731.331 Heasley (North)
21/600.204 High Bickington
31/058.188 Holcombe Rogus
21/533.438 Hore Down Gate
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21/595.312 Landkey
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21/912.447 Luccombe
31/128.325 Lydeard St. Lawrence
21/720.494 Lynton
21/668.486 Martinhoe
21/549.375 Marwood
31/120.260 Milverton
21/970.460 Minehead
21/670.356 Mockham Down
21/808.284 Molland
21/820.303 Molland Common
21/716.258 Molton (South)
21/738.298 Molton (North)
21/825.312 Moorhouse Ridge
21/955.250 Morebath
21/440.456 Morte Point
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21/670.450 Parracombe
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21/465.413 Pickwell Down
21/556.340 Pilton
21/885.468 Porlock
21/850.460 Porlock Common
21/395.247 Portledge
31/114.420 Quantoxhead (West)
21/855.205 Rackenford Moor
21/665.430 Rowley Down
21/919.480 Selworthy Beacon
21/598.374 Shirwell
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31/081.278 Wiveliscombe
21/460.438 Woolacombe
21/939.434 Wootton Courtney
21/720.352 Yard Down

SUMMARY OF THE DISCUSSION

Afternoon Meeting, 10 *December* 1951

Introducing the speaker the Chairman (Professor J. A. STEERS) said that Dr. Balchin had done a great deal of field work on the erosion surfaces of the Exmoor area, and in other branches of geography.

Dr. Balchin had had considerable experience abroad before the war, surveying raised beaches in Spitsbergen, and since the war he had done a good deal of work on the raised platforms of the north Cornish and Devon coasts.

Dr. Balchin then read his Paper.

Professor HOLLINGWORTH (University College, London) remarked that there were now so many erosion surfaces correlated by height alone that it was difficult to map them; the depth of platform of these surfaces was important. He thought that to go back as far as the late Miocene was unnecessary as all the changes in sea-level and the amount of erosion involved could be accommodated in the Pliocene; especially if the early Tertiary surface were assumed not to differ greatly in slope from that now seen; the river development through successive changes in the marine erosion surface should provide a valuable indication. Dr. Balchin had referred to erosion features which followed pre-existing valleys; Professor Hollingworth envisaged a falling sea-level dropping by a series of broad oscillatory changes with the erosion taking place mainly at sea-level and at the turnover, or crest, of the change. In that case the whole valley would be cut immediately before the period of maximum sea-level and would not itself be a very much older surface.

Professor O. T. JONES (formerly Professor of Geology at Cambridge) said that he appreciated that Dr. Balchin had done a tremendous amount of work in the Exmoor area and that if he offered some criticism later, it was not against Dr. Balchin but rather against a method which had become popular of late and with which he was not entirely in sympathy.

Those who had tried to look on surfaces and to discover what they meant would realize that one could easily be misled. Looking at a surface, there might appear to be a definite cliff in the background; when looked at from another direction the cliff was not a cliff at all but a long sloping curved surface; it was easy to regard a steep surface as a cliff. A study of this kind was necessarily subjective and it seemed to him that the only satisfactory way of showing the true form of the surface was to take a series of profiles. Dr. Balchin might have made his case much stronger if he had taken a series of characteristic profiles and then one could see to what extent one feature was a cliff and another a platform, and so on. Supposing there were these steps, it was not possible to rule out tectonic oscillation in such an area. He thought that Dr. Balchin's geological map was misleading. All the exposures of rock on Exmoor he himself had seen were heavily affected by pitch-faulting and in an area of pitch-faulting the boundaries did not necessarily run in the direction of the beds; the lines drawn across the Exmoor area were therefore fictitious. Nor could glacial erosion be excluded. Although the ice did not reach the Exmoor area the glacial climate did; it was an area deeply weathered, and under severe climatic conditions quite a lot of movement might occur, exaggerating some slopes and flattening out others.

Let it be granted that there were steps of a kind (although he believed much more toned down), then why must one assume that they were cliffs? If there were an area rising more or less continuously in height, for instance, there would be cliffs established and there would necessarily be these curves from a lower level extending against a background of higher level—without it being anything to do with the sea at all. The idea that there are represented in this area, and elsewhere, a series of platforms due to marine erosion cutting cliffs back had become quite fashionable in recent years—much too fashionable. It seemed to have started with a visit to this country by Professor Baulig many years ago. Professor Jones had been asked to preside over that very provocative meeting, but had he known what mischief Professor Baulig would cause he did not think he would have consented to preside. Baulig may have been right, he may have been absolutely wrong; his argument had however been carried to a degree which would baffle the credulity of even the most naïve person. In one

part of the country with which Professor Jones was familiar these cliffs and platforms had been found to occur pretty regularly at levels of 100 feet between 400 feet odd and 1000 feet odd. Could anybody believe that the land rose in such a way as to leave cliffs and platforms at every 100 feet through a range of 600 feet?

Supposing an area did rise in this manner with a platform in front of it; it would necessarily be covered by gravel and stones in a way that a marine foreshore is at the present time. If the area rose, a stream which formerly came down to the coast-line would continue out to sea; it would go down the slope of the platform, so that the stream would extend more or less at right-angles to the direction of the cliff at the time. This would happen each time the land rose. There would therefore be a series of such streams, so that in the long run the trend of the stream would be perpendicular to the line of the cliffs. In order to see what happened he had taken Dr. Balchin's plan of the general surface and superimposed on it the modern streams of the area taken from the Ordnance map. Dr. Balchin had met that point beforehand by assuming that some of the streams of an earlier period might have left remnants of their valleys and reoccupied them, instead of (as he knew they should have done) going in the direction of the sloping platform. He had called these things palimpsests.

The general trend of most of Dr. Balchin's lines of cliff was west-north-west and east-south-east; in other words, sloping down from left to right, more like the series of rocks in the middle of Exmoor. The streams of Devon did not show any relation to those lines at all. The curious thing was that the streams to the south of Exmoor ran due south, making an angle of 30° to 40° with the coast-line. The streams of North Devon ran over to the north. That seemed very damaging indeed; one could not call all those streams palimpsests and it was a real difficulty which Dr. Balchin would have to face. It seemed to destroy the validity of the assumption that those platforms or steps had anything whatever to do with the erosion.

Professor Jones thought that Dr. Balchin had taken up much too readily the ideas enunciated, as far as he knew, by Professor Baulig. We must not take it for granted, because one area was said to show it, and apply it to others; it should be examined on its merits. There should be more real evidence to show the validity of the platforms which Dr. Balchin had described.

Miss M. A. Arber (Cambridge) said that she had herself been engaged on the same problem and was pleased to find that all the erosion levels mapped by Dr. Balchin coincided with those she had discovered. She had also noticed in the Bideford area lower stages of erosion than those which he had described; there was a plateau level between 200 and 250 feet and others at approximately 150, 100 and 50 feet above sea-level. After the 50-foot stage the sea appeared to have fallen below its present level, which it seemed to have attained at about the end of the Neolithic period. Certain peculiarities of the coast and valleys also corresponded to stillstands at 100 and at 50 feet. She asked whether Dr. Balchin considered the Fremington Clay to be a fluvial deposit; Dr. Zeuner had described it as a terminal moraine containing large erratic boulders. In her view it was related to a sea-level at between 100 and 150 feet.

Mr. C. Kidson (University College of the South-West, Exeter) said that in recent work on the Exe and its major tributaries, in the course of which he had run lines of levels along the streams, he had encountered many breaks of slope which corresponded remarkably well with Dr. Balchin's erosion levels; that at 1225 feet seemed to be particularly important. He doubted however whether the upper Barle and Exe were superimposed from a Cretaceous cover. Their general direction, it was true, was at variance with the structural trend, but they

were made up of short reaches which followed the strike of the beds and others which followed the dip, or the pitch-faults to which Professor Jones had referred. He thought that many of these faults might be of Tertiary age and if so such movements must have affected the platforms which Dr. Balchin had described. He doubted whether there had ever been a Cretaceous cover in this area. He did not doubt the existence of the platforms but thought them more recent than Dr. Balchin had indicated. One evidence of this was the polycyclic nature of many very minor streams quite close to the sea; that the knick points had not moved far upstream indicated their recent origin.

Professor S. W. WOOLDRIDGE (Professor of Geography, King's College, London) agreed with Professor Jones that there was a subjective element in this type of investigation, but wished to remind him that a highly subjective element was often also present in geology. But the record of field observations was not subjective and where the observer had recorded a break of slope or flat it was open to anyone else to verify it. Whatever the interpretation to be placed upon these features he was quite satisfied that the surfaces and slopes existed on Exmoor as described by Dr. Balchin. The hypothesis which Professor Jones had advanced had been tried out but without satisfactory results: it was up to the genuine critic to put forward the same evidence in the same detail and produce an interpretation equally coherent. Professor Jones had touched upon a vitally important point when he raised the question of the relation of the drainage to the former cliff lines; but this problem was known also and Professor Jones appeared to have overlooked the fact that the difficulty would not arise if a land in a state of fairly broad dissection were submerged.

The point that had been made regarding the drainage of Exmoor could also be made in the case of the Tamar valley. One should look at the pattern of the drainage of the Tamar and its tributary streams and then remember that many years before Professor Baulig was in London, George Barrow and his colleagues in the Survey had clearly established the existence of at least three platforms in Devon and Cornwall.

Professor Wooldridge did not like an undue multiplication of surfaces, and was suspicious of marine surfaces ranging upwards to include even the summit slopes of quite high mountains. But Exmoor was different: the range of height is less and the summit heights are much lower. He also felt that those who criticized the marine erosion hypothesis in western Britain should bear in mind the clear evidence of marine action, complete with marine deposits, which existed at comparable heights in south-east England. He could not agree with Mr. Kidson's observations on the drainage and in this respect he supported Dr. Balchin's hypothesis that the drainage of Exmoor was to a certain extent epigenetic in origin.

Dr. A. T. J. DOLLAR (Birkbeck College, London) described work recently carried out by him on the raised beaches of the island of Lundy. These features were of undoubted marine origin and formed a series between the present sea-level and the 400-foot platform: they supported the eustatic hypothesis put forward by Dr. Balchin.

Mr. E. H. BROWN (University College, London) considered that surfaces corresponding to those described by Dr. Balchin could be traced, at much the same heights, along the coasts of Wales and felt that eustatic changes in sea-level were necessary to explain them. He agreed that it was undesirable to multiply the number of hypothetical surfaces, but asked whether Dr. Balchin had found evidence for a split in the 600-foot surface. This surface could be recognized in the valleys of the Teifi and Towy, but when traced upstream resembled a fluvial feature—the old flood plain. He suggested the possibility

that this was also the case with the Buckland coastline on Exmoor. Mr. Brown added that the earliest reference to a marine platform was perhaps by Ramsey in 1846 and one should not forget that Professor Jones had himself recognized a 600-foot coastal plateau in the Aberystwyth district in 1910, and had also drawn attention to falling levels on the Towy. As to the relationships of the drainage pattern, he alluded to his own recent work on the Ystwyth where a change in direction at right angles to the coast-line was to be seen at 690 feet, the equivalent of Balchin's Buckland coast line.

In a written contribution to the discussion, Professor LINTON (Professor of Geography, Leeds) said that Dr. Balchin had raised a question which required careful consideration. If this series of erosional benches was indeed due to eustatic changes of sea-level, virtually the whole of the English plain must have been submerged at some period in mid-Tertiary times. The whole drainage pattern of the English plain must then post-date this episode and should show both a unity of pattern within the area transgressed and a contrast with the unsubmerged uplands. The 1225-foot cliff line on Exmoor should be recognizable elsewhere. There were anomalous features on the eastern flank of the Pennines for which that hypothesis might offer an explanation, but no fundamental contrast in the drainage pattern was apparent at that level. Such a contrast in the drainage pattern was to be seen at a lower level, but it implied a transgression into the Pennine upland only to the 600- or 700-foot contour; this recalled the pattern in Wessex and the Weald and it was significant that Dr. Balchin had demonstrated a marked change in the character of the country at the 675-foot Buckland level in Exmoor. It was possible that higher cliff lines might be found in Wales and northern England if these areas were examined as thoroughly. On the other hand, the sea may have cut cliffs in the hard rocks of Exmoor at this level while softer rocks, now removed, formed a coast-line that ran eastwards from the Bristol Channel. To the north there may have been a peneplain of which no vestiges remain and its rivers may have survived into the next cycle of erosion. Only further field work could decide between such hypotheses.

Dr. BALCHIN in reply expressed his thanks to those who had taken part in the discussion. The points of agreement with Miss Arber, Dr. Dollar and Mr. Kidson, whose own field work had taken them into the Exmoor area, were particularly gratifying. Miss Arber had queried the Fremington clay deposit: this problem was dealt with in more detail in the text, evidence there being advanced in support of a fluvial origin for the clay. Mr. Brown's comment on possible sub-divisions of a surface was very relevant. At this juncture only the major episodes had been distinguished; minor breaks of slope, difficult to correlate, do occur in places and may well represent minor stillstands locally preserved in the general emergence of the area. Dr. Balchin particularly thanked Professor Jones for stating the opposition's case and for providing the basis of a most stimulating discussion. Some of the points raised by Professor Jones had been effectively answered by Professor Wooldridge, others were covered in the full paper, whilst the geological map presented with the paper and criticized by Professor Jones was largely a compilation from a variety of reports prepared by acknowledged geologists. Although inadequate it did not represent any fundamental divergence from existing ideas of the geological build of the Exmoor area.

LAND AND POPULATION PROBLEMS IN FIJI

EILA M. J. CAMPBELL

THE CROWN COLONY of Fiji is an interesting example of a tropical country in the process of settlement and development. Its problems are many: to reconcile the interests of Fijian, European and Indian is no mean task, and the Colony's peaceful atmosphere speaks highly of Government by a Legislative Council on which all three peoples are represented. At the half-century, the rapidly expanding Indian community is emphasizing the growing pressure on the small proportion of land suitable for cultivation or grazing. The Indians' increasing numbers have recently caused a fundamental change in Fiji's population structure. Since 1945, they have formed the largest single racial group and now substantially outnumber the Fijians. Moreover, their higher fertility rate and their earlier marrying age will further accentuate this disparity during the present generation (Table 1). Between 1921 and 1946 the Indian population practically doubled, without any significant accretions from immigration; migration on a large scale from India ceased in 1918. If present trends continue—and the Indian gross reproduction rate is, in fact, accelerating owing to the improved ratio between the sexes and the higher proportion of women of child-bearing age, Indian numbers will again double by 1967, a period of only twenty-one years. Greatly increased production will be necessary if standards of living are to be maintained at the present level, which cannot be regarded with complacency. Over the period 1939–49, the rate of natural increase of the Indian community in Fiji has averaged thirty-five per thousand.[1]

Table 1. *Fiji's changing population* 1881–1949 [2]

	1881	1901	1921	1946	1949
Fijian	114,748	94,397	84,475	117,488	126,650
Indian	588	17,105	60,634	120,063	133,941
Others [3]	12,150	8,622	12,157	22,087	24,364
Total population	127,486	120,124	157,266	259,638	284,955
	Percentages				
Fijian	90·01	78·58	53·71	45·25	44·44
Indian	0·46	14·23	38·56	46·24	47·00
Others [3]	9·53	7·19	7·73	8·51	8·56

The Fijians are also steadily increasing, although their crude birth rate is lower, and their infant mortality rate higher than the corresponding figures for the Indians. The other sections of the population also maintain a high rate of

[1] This is higher than the equivalent rate of the Indians in Mauritius where the slightly higher birth rate is offset by a considerably higher death rate owing to the incidence of malaria. (Fiji is free from the malaria-carrying mosquito.) The birth rate has averaged forty-two per thousand.

[2] Source: Fiji Census Reports, except for 1949 (Registrar-General's estimate).

[3] Europeans, part-Europeans, Chinese and other Pacific peoples.

natural increase, but they form so small a proportion of the total population that they can be discounted in considering the increasing pressure on the land. It is however significant that Fiji's average annual rate of natural increase, averaging twenty-six per thousand, is one of the highest in the world.

The Colony comprises some 322 islands with an aggregate area of 7083 square miles. Only four islands, Viti Levu, Vanua Levu, Taveuni, and Kadavu, exceed 100 square miles in extent. Viti Levu, the principal island, comprises about 57 per cent. of the total area and had at the last census 69 per cent. of the population.[1] The population is settled essentially on the flat lands avoiding the mountainous interiors of the islands, and for this reason overall densities are of little value. They range all the way from 6·2 to more than 9000 persons per square mile. The island of Serua, for example, has a density of 6000 persons per square mile, but its cultivated land is on the main island of Viti Levu. The majority of the Indian people are still settled in or adjoining the sugar-producing districts of the two principal islands.

Table 2. Fiji: Land use, present and estimated potential[2]

Use	*At present*		*Maximum possible*	
	Acres	*Percentage of total*	*Acres*	*Percentage of total*
Agricultural land				
General arable farming ..	72,939	1·6	150,000	3·3
Sugar cane	160,000	3·5	200,000	4·4
Coconuts	120,000	2·7	200,000	4·4
Grazing lands	152,300	3·4	300,000	6·7
Total	505,239	11·2	850,000	18·8
Forest reserves				
Actual, forested and productive	52,225	1·1	1,000,000	22·1
Actual, forested protective ..	30,505	0·7	1,000,000	22·1
Deforested to be planted, productive	Nil	Nil	1,000,000	22·1
Deforested to be planted, protective	Nil	Nil	660,000	14·7
Total	82,730	1·8	3,660,000	81·0
Undeveloped land				
Forested	1,725,000	38·2	Nil	Nil
Deforested	2,200,000	48·7	Nil	Nil
Total	3,925,000	86·9	Nil	Nil
Roads, towns and other non-productive areas	4,151	0·1	7,120	0·2
Total area	4,517,120	100·0	4,517,120	100·0

[1] 'Census Report,' 1946.

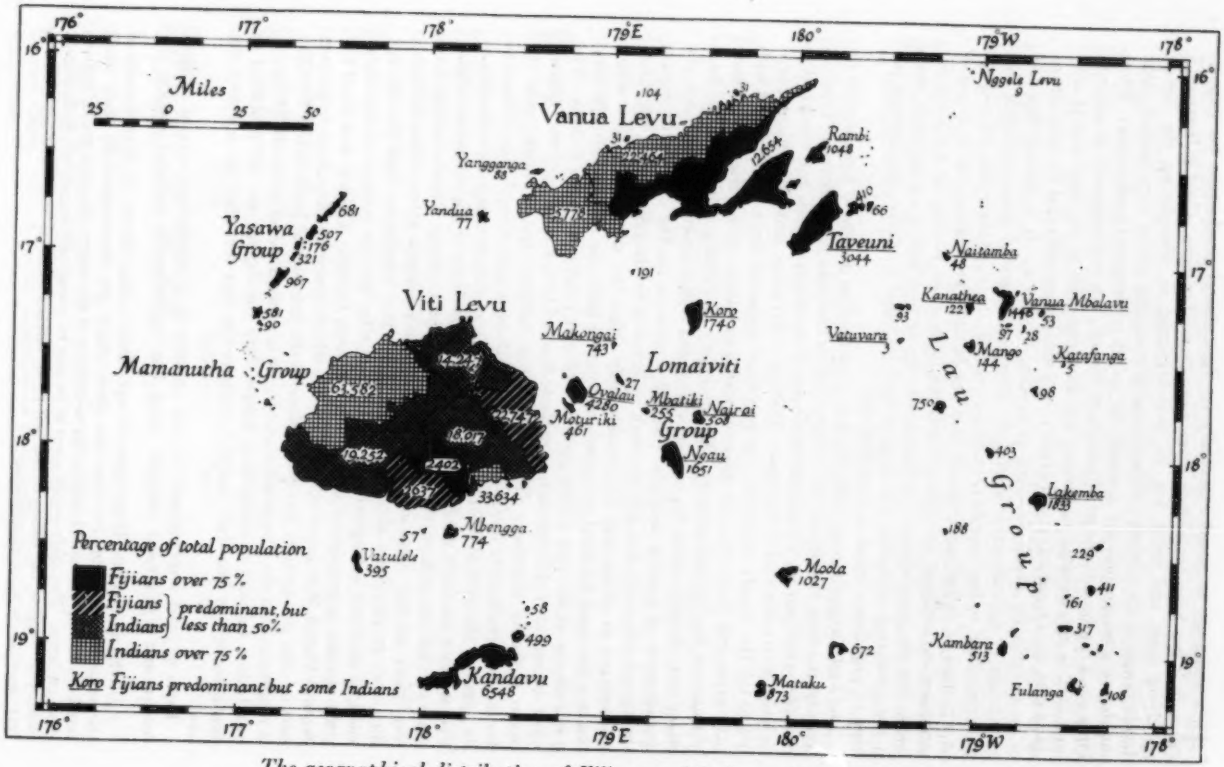
[2] Source: Department of Forestry Annual Report for 1948 and 1949. "Legislative Council Paper," No. 15 (1950). Compiled in consultation with the Department of Agriculture.

Fiji's economy is based essentially on agricultural production for export, although it has been broadened since 1935 by gold mining. Gold is however a vanishing asset and must not be overestimated in considering the future development of the Colony. Other mineral resources are of very limited value and do not exist in sufficient quantity to justify commercial exploitation. Thus Fiji's chief resource is the productivity of its soil, but unfortunately its agricultural land is very limited in extent; less than one-fifth of the total area is considered by the Department of Forestry, in consultation with that of Agriculture, to be suitable for arable farming or grazing (Table 2). It is against this low percentage of agricultural land and the relative absence of mineral wealth that the expanding Indian numbers must be viewed. In 1949 there was an average of 1·7 acres of actual agricultural land per head of population, or in terms of estimated agricultural area but present population, an average of 2·8 acres per head. But the population is increasing so rapidly that within a generation, even if the estimated potential agricultural land becomes a reality, the acreage per head of population must in fact diminish.

The high proportion of land which it is planned to devote to forests must be forested in order to prevent soil erosion and to facilitate flood control. Tropical rain-forest still covers the windward slopes of the larger islands and would seem to have been universal in the past. Shifting cultivation, and subsequent burning to kill the woody regrowth, has produced apparent dry zones covered with poor grass and reeds on a soil entirely lacking in humus; this is the present state of much of the low hill country. To the legacy of shifting cultivation has been added the damage done by over-stocking and indiscriminate firing since the introduction of grazing animals. Excessive pressure on the crop lands during the recent war years has left its mark in lowered production, and marked improvements in yields will be possible only when the community as a whole realizes the need for land use planning; wrong land use and wasteful farming methods are at the root of the problems of many farmers in the Colony. The most intensively cultivated acres are those worked by the tenants of the Colonial Sugar Refining Company. The partnership between the Company and the Indian farmers is particularly successful and there is keen competition to become its tenants; the individual tenant holdings are 10 acres but they are so arranged that sections similarly used adjoin, thus aiding methods of harvesting on a large scale carried out collectively. Most of the Indian holdings leased directly from the Fijians are too small in extent to permit an economic return from farming; they vary in size from about 2½ to 12 acres. It is significant that the average yield of cane per acre produced by farmers who are not tenants of the Company is some 3 tons lower than that of its own tenants. During and since the Second World War green manure fallow, which formerly played an important part in cane production, has given place to the growing of food crops. Fertility is maintained on the Company's land by an increased use of artificial fertilizers, but Indian farmers working land leased from the Fijians are not prepared to spend money in this way, mainly owing to the fact that they do not own the land.[1]

Basic to land improvement in any country is a satisfactory system of land tenure and Fiji's most valuable asset has undoubtedly suffered during the

[1] Fiji has an excellent Department of Agriculture whose officers are keenly aware of the value of Extension Services, but their efforts are handicapped by their small numbers and by the recent drift to the townships of the better educated young Indians born on farms. This drift would seem to be due to a tendency among the Indian community to relegate the tilling of the soil to an inferior place in the social scale and to seek work as clerks or middlemen.



The geographical distribution of Fijians and Indians. (Census of 1946)

present century from the fact that so much of it has been worked on short leases. It was in an effort to put an end to the many abuses [1] which had arisen that the Native Land Trust Ordinance of 1940 was enacted on the initiative of the Fijian Council of Chiefs.[2] Under this ordinance the control of all Native Land [3] is vested in a Board charged to administer it for the benefit of the Fijians who still possess some 83 per cent. of their Pre-Cession domain.[4] This Board is empowered to set aside any portion of Native Land as a reserve for the exclusive use of Fijians, in order to provide sufficient land for their increasing numbers; land thus set apart may not be either leased or otherwise disposed of to a person of any other racial group. Surplus land outside the reserves is available for leasing to members of other races at the Board's discretion. The Board has the help of local committees which may include an Indian representative. The problem for the Indian, as indeed for the whole community, lies in the fact that outside the Reserves there appears to be insufficient land, not already alienated, capable of sustaining a large population at a reasonable standard of living.

The work of the Native Land Commission in determining the extent of the Reserves was delayed by the War and the first reserves were proclaimed only in 1949. These were in the sugar-growing districts of Ba and Nadi in north-western and western Viti Levu, where Indians predominate and where there is a shortage of arable land for the Fijians themselves. This shortage is intensified by the present policy of trying to raise their standard of living by encouraging more of them to grow cane as a cash crop. The proclamation of Native Reserves in these districts, and elsewhere in the Colony, does not mean that all the Indian tenant farmers are immediately displaced, but it does mean that they will not be permitted to renew their leases on expiration. Thus the actual displacements will be spread over the next twenty years, and the problem of resettlement is therefore not an immediate one for a majority of the Indian tenant farmers in the Reserves already proclaimed. It will however become a very pressing problem in the next twenty years and will coincide with an increasing demand for land, due to the high Indian birth rates in the 1940s. An active policy of developing the plateau country of the two principal islands is thus of first priority and there can be little doubt that the situation calls for the immediate setting up of a Land Settlement Department. Such a Department would help the Indians to establish themselves in the interior where at present there is no recognized way by which they can earn money. It may be argued that the initiative should come from the Indian community itself, since its members regard themselves and are regarded by the Government as an integral part of the Colony. But the events of the last twenty years would suggest that the better educated Indians in Fiji are not yet ready to aid their less prosperous fellows, and there is still a very marked tendency to place the onus of any welfare schemes on the Legislative Council.

A Homestead Scheme, on the lines of the *Comisión de Hogares Seguros*, which proved so successful in Puerto Rico during the early 1930s, would probably be most opportune.[5] Some modifications would of course have to be made, since

[1] Especially those of sub-leasing.

[2] "Legislative Council Paper," No. 12 (1940).

[3] Native land is defined as land which is neither Crown land nor the subject of a Crown grant or native grant, but includes land granted to a *mataqali* (Fijian land-owning group) under Section 19 of the Ordinance.

[4] Of the small area lost to them, more than half was alienated as a result of sales prior to the Act of Cession of 1874.

[5] T. Roosevelt, "The Land Problem in Puerto Rico and the Philippine Islands," *Geographical Review*, 24 (1934) 182.

in Fiji no further land may be alienated. The settlers might however be granted ninety-nine years' leases in lieu of freehold land. Money for such a scheme is available, as the Development Revision Committee set aside a sum of £F150,000 as "a start in the direction of agricultural and industrial credit." [1] Provision has also been made for a road building programme in Viti Levu but no money has been set aside for road making in Vanua Levu.[2]

Without the aid of either the government or the stimulus of his own leaders, it seems very doubtful whether the small Indian peasant farmer could establish himself away from the sugar-cane growing districts. The Indian farmers in Fiji would seem to be individualists who do not appear to take kindly to cooperative enterprises; indeed their response to the recent facilities afforded them for forming cooperative societies has been very disappointing.[3] But they do welcome the opportunity to become tenants of the Colonial Sugar Refining Company. Clearly it should be possible to apply the experience of the Company to the production of other industrial crops on the now unoccupied lands. A clearer view of their possibilities for development must await the completion of the aerial survey, at present in progress. But it appears from ground reconnaissance surveys that much of the land available is of marginal value and would be easily eroded under haphazard systems of cropping, thus making planned settlement essential.

The Revised Development Programme is further handicapped by the fact that there is a lack of skilled labour and that neither the Indian nor the Fijian is a ready source of labour: the Indian is averse to manual work except on his own holding, while the Fijian has still the Pacific Islander's approach to work and time. Moreover one in two of the combined Indian and Fijian populations is under fourteen years of age. Although there is a considerable pool of Indian women between fourteen and nineteen, such is the weight of tradition that the Indian girl in Fiji is married as soon as possible after she is thirteen years old. The slow working pace of the Indian labourer and the apparent inability of the Fijian to sustain an initial physical effort have a partial explanation in dietary deficiency, particularly of animal protein and fats.

In conclusion, the solution of the Indian's increasing numbers is at root a sociological rather than a geographical problem, since there is clearly a limit to the possibilities of extending settlement in the restricted area of the Colony and it is unrealistic to look for a solution in emigration. In the long run, the Indians in Fiji can maintain and improve their present standard of living only by a voluntary reduction of their high birth rate. [4]

This article is based on a paper read to the British Association, Section E, at Edinburgh in August 1951. The author wishes to acknowledge her gratitude to the New Zealand Government and to the New Zealand Federation of University Women whose very generous financial assistance made possible her visit to Fiji in September 1950.

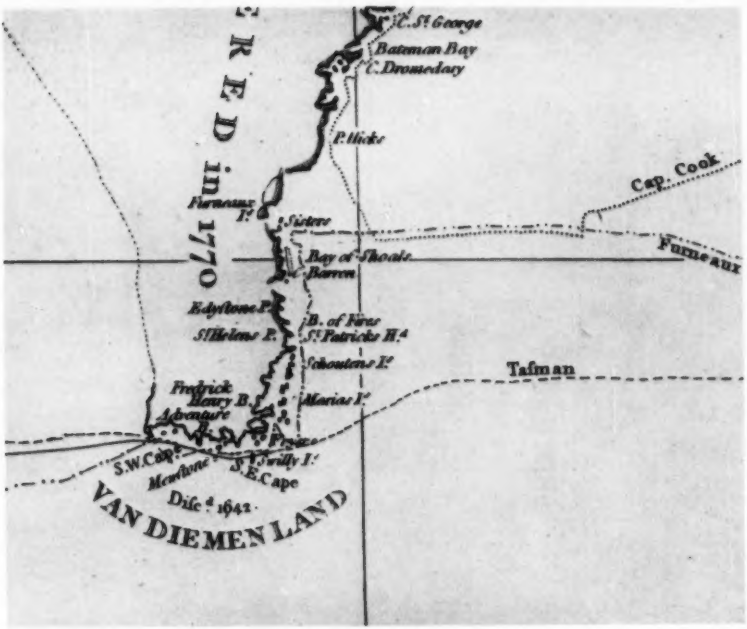
[1] *Cf.* Development of Revision Committee Report, "Council Paper," No. 29 (1949).

[2] Eighty per cent. of the total sum available is to be spent on Viti Levu—a policy already criticized by the author of the minority report by the Development Revision Committee, *cf.* "Council Paper," No. 30 (1949).

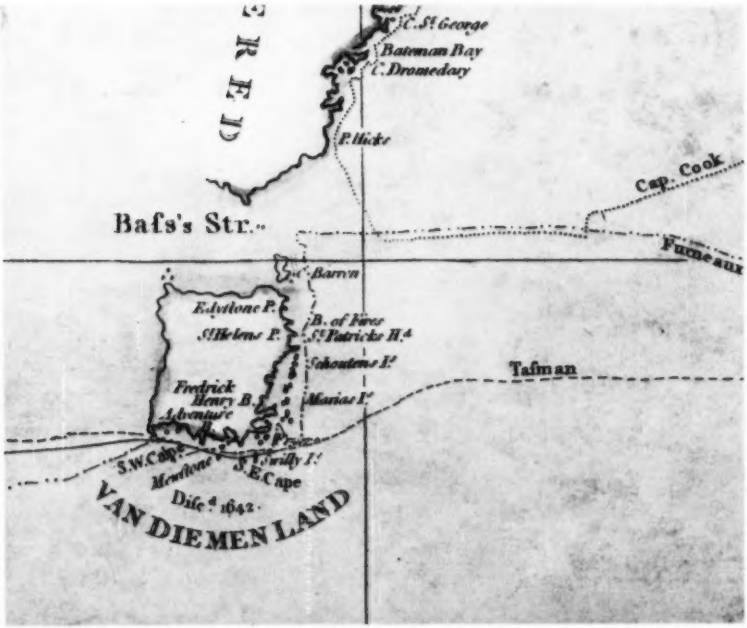
[3] "Annual Report for 1949 of the Registrar of Co-operative Societies," "Council Paper," No. 22 (1950). Only two groups of Indians have registered, the one a group of the C.S.R.Coy's tenant farmers whose object is the purchase and use of agricultural machinery and implements; the other a consumer society.

[4] *Cf.* "Fiji Council Paper," No. 18 (1949), p. 3. Address by His Excellency the Governor.

Serua, this small island, has a density of 6000 persons per square mile
Whites Aviation, N.Z.



From the original issue of 1 April 1790



As corrected and re-issued probably before May, 1800

From A. Arrowsmith's "Chart of the World on Mercator's Projection"

THE FIRST PUBLISHED REPRESENTATION OF TASMANIA AS AN ISLAND

M. AUROUSSEAU

TWO ISSUES OF a wall-map by A. Arrowsmith have recently come under examination in the Map Room of the Royal Geographical Society. Both are dated 1 April 1790, and entitled "Chart of the World / on Mercator's Projection, Exhibiting all the New Discoveries to the present Time: / with the Tracks of the most distinguished Navigators since the Year 1700, carefully collected / from the best Charts, Maps, Voyages, &c. Extant. / And regulated from the accurate Astronomical Observations, made in three Voyages, / Performed under the Command of Captn James Cook, / in the Years / 1768, 69, 70, 71.—72, 73, 74, 75.—76, 77, 78, 79, 80. / Compiled and Published by A. Arrowsmith, Geographer."

One copy, presumably of the earlier issue, was cut and mounted on linen many years ago, and now measures 51×81 inches. Only the eastern part of Australia is shown on the western side of the map, but the whole continent is shown on the eastern side, though with slight differences. The correct information "Discd 1642" appears above the name of Van Diemen's Land on the eastern representation, but the mis-statement "Decr 1742" appears at the corresponding place on the western. The western and southern coasts of Australia are shown according to the Dutch navigators, and the eastern according to the preliminary interpretation of Cook's work. Van Diemen's Land is shown as a conjectural continuation of the Australian mainland.

The other copy, presumably of the later issue, was formerly mounted on rollers but has recently been cut for convenience in filing. It resembles the earlier in nearly all respects, but it shows Van Diemen's Land as an island. This is probably the first published representation of the complete separation of Tasmania from Australia. The true date of publication of this issue is therefore of decided interest. For satisfactory discussion of the point, reference will have to be made to a folio volume of maps and charts now in the Map Room of the Royal Geographical Society ("the Chapman Collection"). The contents were described in the *Geographical Journal*, 108 (1946) 112, as a collection made by a Captain Benjamin Chapman in Ireland before 1808. The MS. title page, not mentioned in the note in the *Geographical Journal*, reads: "General Atlas / being a / Collection of / Maps and Charts / Selected and compiled / by Mr. Andrew Gray."

Although later generations gave Bass the entire credit for the discovery of Bass strait, it is now becoming clear that Bass's contemporaries knew that Hunter believed firmly in its existence long before he sent Flinders and Bass to prove it by circumnavigating Van Diemen's Land in the *Norfolk*. On 1 October 1798, before this proof was forthcoming, Arrowsmith published a "Reduced Chart of the Pacific Ocean from one published in Nine Sheets" (No. 48 of Chapman Coll.), on which the coast of Van Diemen's Land is from Tasman and Furneaux, that of New South Wales from the revised plotting of Cook's work, that of the south-western corner of Australia from Vancouver; and a clear space is left betweeen Van Diemen's Land and the mainland in the latitude of the strait. In his 'Observations on the coasts of New South Wales, intended to accompany the charts of the late discoveries in those countries'

(London, 1801) Flinders wrote (p. 34) of "confirmation of the former suppositions of an existing strait," a remark which has hitherto passed unnoticed. And Lieut. James Grant, R.N., in 'The narrative of a Voyage of Discovery, performed in His Majesty's vessel the Lady Nelson, . . . in the years 1800, 1801, and 1802, to New South Wales' (London, 1803) wrote (p. 148) of Hunter as "the first who ever suggested such an idea, and, no doubt, encouraged the search . . ."

The following incidents bear on the question of the date of Arrowsmith's first delineation of Tasmania:

(1) On 3 September 1798 Hunter sent Nepean a copy of a small chart showing discoveries by Bass and Flinders, which strongly supported his own belief in the existence of a strait (*Hist. Rec. Australia*, (I) 2 (1914) 220–1). It could have arrived in England at any time between the end of December 1798 and May 1799.

(2) Flinders and Bass circumnavigated Tasmania between October 1798 and January 1799, and Hunter sent Flinders' chart of Bass Strait Home on 15 August 1799 (*Hist. Rec. Australia*, (I) 2 (1914) 381). It could have arrived at any time between January and April 1800.

(3) Flinders' chart of the whole of Van Diemen's Land and Bass Strait (No. 50 of the Chapman Coll.) was published by Arrowsmith on 16 June 1800, which means that both the Admiralty and Arrowsmith must have dealt quickly with Flinders' material.

(4) While Grant was at the Cape he received orders from England "to search for the Strait which separates Van Diemen's Land from New Holland." He was at Simon's Bay from 17 July to 7 October 1800, by which time the news of Flinders' circumnavigation of Van Diemen's Land could easily have reached the Cape from England; but Grant had only a "small chart given to me by Sir Joseph Banks"—possibly a copy of that sent Home by Hunter in September 1798. (Grant, *Op. cit.* 40, 54 and 74.)

(5) Flinders himself arrived back in England on 26 August 1800 (Ernest Scott, 'The Life of Matthew Flinders,' Sydney, 1914), too late to supervise the treatment of his work on Van Diemen's Land. The other charts dealt with in his 'Observations on the coasts of Van Diemen's Land, etc.' (Nos. 51 and 52 of the Chapman Coll.), were published by Arrowsmith on 20 February 1801. Attention is here drawn to the fact that specified parts of the work on two of his charts (Nos. 50 and 52 of the Chapman Coll.) are directly ascribed to Bass.

On the later issue of Arrowsmith's "Chart of the World" under consideration here, Wilson's promontory and Western Port on the coast of New South Wales (as it then was), are crudely shown but can be identified. This part of the outline is therefore taken from Bass's work, and probably from the small chart sent Home by Hunter in 1798. The north and west coasts of Van Diemen's Land are crudely completed in a thinner line than the rest of the outline and carry no names. Three small dots off the north-west corner of the island are clearly Hunter's isles, which were discovered by Flinders. It therefore seems evident that Arrowsmith, hastily bringing his chart up to date, was not then working from Flinders' drawings but only from a report (of what form it is impossible to guess) of the main results of his survey. This too seems to have been all the information the Admiralty had time to send to Grant before he left the Cape. To have reached Grant at the last minute, it would have had to have been despatched from England not later than the beginning of June 1800. But not until June 16 did Arrowsmith issue Flinders' chart of

Bass Strait and Van Diemen's Land, on which his staff must have been at work during the previous month or more. The correction of the later issue of the "Chart of the World" to show Van Diemen's Land as an island must therefore have been after January but before May in 1800. An unsigned letter from Sydney, dated September 1799, on the proved insularity of Van Diemen's Land, appeared in the July number of *The Gentlemen's Magazine* in 1800.

A half-sheet (part of a world map on the globular projection) published by Arrowsmith and dated 1 January 1794 (No. 5 of Chapman Coll.) seems also to have been corrected, but rather more carefully, at the same time as the "Chart of the World," or a little later. Van Diemen's Land is evidently from Flinders' work, though not from his chart, for Port Dalrymple is not shown, but Hunter's isles are named. (This half-sheet is interesting, too, in another respect: the treatment of the southern and eastern coasts of Australia suggests that Arrowsmith was undertaking the complete revision of his representations of Australia, by rejecting the work of the Dutch navigators, and cleaning his copper plates for the incorporation of the results of contemporary exploration.)

The next maps to show Bass Strait and the island of Van Diemen's Land seem to be two plates dated "Aug. 1st" and "Dec. 21st", 1801, of the hemispheres and of the world respectively, and included as Plates 1 and 2 of Cary's 'New Universal Atlas' (London, 1808). After Cary, Faden was quick to bring his work into line with the state of knowledge. His "Eastern Hemisphere" and "Southern Hemisphere," both issued on 1 May 1802, and included on Plates 1 and 4 of his 'General Atlas' (London, 1804), show Bass Strait and the island of Van Diemen's Land, the outline of the latter and some of the names being clearly taken from Flinders' work. The only other early representation of Van Diemen's Land as an island of interest here seems to be on Cary's 'Pocket Globe agreeable to the latest Discoveries' (London, 1791), an example of which has recently been submitted to the Royal Geographical Society for examination. "Basses Str." is named. As Cary was prompt in recording the existence of the strait on the plates of his atlas, it is reasonable to suppose that he brought his pocket globe up to date at the same time. The specimen under consideration is therefore probably an issue corrected late in 1801.

On none of the maps mentioned above is the work of Grant shown. The *Historical Records of Australia* (1), 3 (1915), leave doubt about the date on which his papers were sent to England; but Dalrymple issued the official Admiralty chart of Bass Strait and Van Diemen's Land on 27 January 1803. It embodied not only Grant's work but also that of Black of the *Harbinger* and Buyers of the *Margaret* in 1801, which first brought King island, actually discovered by Reed or Reid of the *Martha* in 1798 (*Hist. Rec. N.S. Wales*, 4 (1896) 1009), into clear cartographic view. In the note in the *Geographical Journal* (*loc. cit.*), Arrowsmith's 'Chart of the Pacific Ocean' in nine sheets (No. 49 of Chapman Coll.) is said to be "a corrected issue of 1803 or later," but, were this so, it is likely that Arrowsmith would have brought it into agreement with the Admiralty chart of 27 January 1803 by showing King island and the results of Grant's work. It is possibly a corrected issue of 1802. Grant's own narrative (*Op. cit.*) bears the date 1803 on the title-page, but the chart which illustrates it is dated 27th Decr. 1803 and the plates are dated Jany 10, 1804. King island seems not to have appeared in British atlases until 1817, when Arrowsmith showed it in 'A New General Atlas' (Edinburgh). As Baudin's vessels were investigating the region in December 1802, and Freycinet's 'Carte générale de la Nouvelle Hollande' was on sale in France in 1808, it is not surprising to find "I. King" and "I. de King" in P. Lapie's 'Atlas classique et universelle de Géographie ancienne et moderne' (Paris) as early as 1812.

FROM THE *JOURNAL* A HUNDRED YEARS AGO

IN HIS PRESIDENTIAL ADDRESS to the Society on 24 May 1852, Sir Roderick Impey Murchison, F.R.S., referred to the effect of environment on some South African tribes (*Journal of the Royal Geographical Society*, vol. 22, page cxix) in the following passages:

"Mr. F. Galton, to whose researches your attention was directed last year, and who has been absent during two years, has returned with an account of the result of his last travels. Having journeyed about 1600 miles between Walfisch Bay on the south, and Ondonga, in 17° 58′ S. latitude, near the Nourse river, on the north, and extending his explorations inland to the 21st degree of E. longitude, he has made a very important addition to our acquaintance with the geography of Southern Africa.

Through this journey (accomplished entirely at the expense and by the energy of Mr. Galton) we obtain a description of the Dammara people, who, though a race of fine stature, are in a low moral state and likely to be extinguished by the more powerful and enterprising Namaquas. The high table-land, which was traversed to reach the Ovampo, is cut through by deep ravines, the chief of which serve as escapes for the periodical floods of the rivers. Like his contemporaries on the eastern side of the African watershed, Mr. Galton passed over a great saline deposit, as if the residue of a desiccated lake, and met with a brackish, a tepid, and a very hot spring.

In delineating the moral character, as well as the physical conformation of the different tribes or nations of South Africa, it is interesting to observe, from the observations of Mr. Galton, how their differences are connected with the form, subsoil and vegetation of their respective lands. Thus, the arid inland plateaux, covered only with thick jungles and short brushwood, hold the dwarfed and sinewy Bushman; the more open, hilly and undulating pasture-lands the Dammaras, a nation of independent herdsman, each chief of a family being supreme in his own little circle; whilst the rich corn-lands on the north are occupied by the race which is the most civilized and advanced, the Ovampo. Ondonga, the capital of this people (whose king would not permit our traveller to proceed northwards), is estimated to be about 70 or 80 miles to the south of the great river Amorongo Achilunda, the Nourse of our maps."

A HUNDRED YEARS OF THE AMERICAN GEOGRAPHICAL SOCIETY

GEOGRAPHY IN THE MAKING. By JOHN KIRTLAND WRIGHT. *New York: published by The American Geographical Society; printed by George Grady Press*, 1952. 10×7 *inches;* xxi+437 *pages; maps, diagrams and illustrations.* $5

WHEN Mill wrote 'The Record of the Royal Geographical Society 1830–1930' he had to resist "the temptation to make the book a history of geographical discovery." The British reviewer of Wright's corresponding history of the American Geographical Society of New York must resist an equally strong temptation to compare or contrast it with Mill's 'Record.' The American society and our own matured in circumstances that were entirely different. Our Society was established in the capital of a country within easy distance of the Continent, and of a country vigorously engaged in exploration and colonization. The American society holds its charter not from the nation but from the State of New York; and, from the return of Wilkes' expedition in 1842 to the despatch of Byrd's expedition in 1946, the United States did not compete in the exploration of the world by sending major expeditions of national character to places outside the Americas, except in the Polar regions. National energy was applied mainly to the exploration and development of the United States themselves. The American society, seen from here, grew up in national and international isolation. Not until it organized the Transcontinental Excursion of 1912 did it come into really close touch with kindred societies abroad, and not until 1918 did it play an important part in international affairs. Nevertheless, in the course of a century it has transformed itself, from a small organization serving the intellectual and business interests of the city and state of New York, into a truly American institution equal in stature to the corresponding societies of Europe.

Wright has traced the record of its growth and performance very frankly and in detail, in a book addressed primarily to the society itself, but a book so good that it will rank as a contribution to the history of geography—not the first he has given us. His own warm and entertaining presence pervades the volume, but he is at his best when bringing to life the lower Manhattan of the 'sixties and 'seventies of the last century, and when presenting his colleagues of the last thirty years. Ever since its foundation the society has seen its main duties as the provision of full and reliable information on all parts of the world, the propagation of geographical knowledge through its lectures and publications, and the encouragement of exploration. It has consistently urged the execution of geographical projects conceived for the benefit of the United States, from the building of the railways and the cutting of the Panama Canal, to the provision of adequate charts for aerial navigation. One of its early successes was the official execution of its plans for the accurate topographical survey of the state of New York. Its constant endeavour has been to increase its revenue in proportion with its expenditure, and its constant anxiety, until 1912, was to provide adequate housing, in a fire-proof building, for its great and growing collections. It has passed through hard times, particularly during and just after the Civil War, and has known periods of stagnation from which it has learnt how to maintain vitality and vigour in its governing body.

Under the presidency of Henry Grinnell and of Charles P. Daly, and under

the directorship of Isaiah Bowman, the society manifested great vitality, particularly under Bowman. It would be easy to conclude that the state of such a society at a given time depends entirely upon its officers; but Mill's 'Record' shows that the prosperity of our own Society, as expressed by the number of Fellows, was markedly affected by the changing fortune of the times. The history of the American society shows the same relationship, and demonstrates clearly that the task of the executive is harder, much harder, in the lean than in the prosperous years. It is in the quality of its technical performance that such a society reflects the character of its leaders, and the performance of the American Geographical Society under Bowman was dazzling (see *Geographical Journal*, 98 (1941) 61–62; 115 (1950) 138 and 226–230). The society would probably have flourished well during the same period under any energetic administrator with an eye for men, maps and country; but whoever knew Bowman would deny that anybody but he could have brought forth the same measure of performance. The truth, I believe, is that Bowman matched the opportunity. When he was appointed the United States were prosperous, confident and entering into a markedly creative period (American literature of the 'twenties reached a high-water mark). The society had an enlightened, wealthy and very active council two of whose members were its munificent patrons. It was at last installed in its handsome, fire-proof building, the gift of Mr. Archer Huntington, on Broadway at 156th Street. And it accepted Bowman's grandly conceived programme for reorganization and research. Bowman's great administrative gift was that he could select and inspire a team worthy of his clear purpose. He knew exactly what he wanted to do and was liberally provided with the means; yet who but he could have "effected a substantial direct increase in revenue" amounting, between 1915 and 1935, to 781,000 dollars, "besides inspiring rich men to contribute to the Society's support"? Times however were changing rapidly towards the end of his administration. The society's heavy investment in guaranteed mortgages proved to have been ill-advised and financial reorganization became necessary. In 1932 "no books were bound, no maps were mounted, and purchases of new books and maps were almost discontinued." On May 20 of that year the staff was told that "the Society cannot hereafter promise either tenure or salary" and salaries were reduced until June 1935. Bowman's successful appeal to the Rockefeller Foundation was all that saved the society from insolvency. When Wright was appointed Director in 1938 he was confronted with a deficit. And the spacious building of 1912 was no longer big enough to accommodate the staff and the ever-growing collections. Thanks, however, to the wisdom and energy of its administration, the American Geographical Society passed successfully through one of the most precarious phases of its existence, and now faces an ambitious programme of research, particularly in medical geography, with confidence.

For European societies the struggle against the times is still hard. The Société de Géographie, the oldest of its kind, has had to return from palatial quarters in the Hôtel Bonaparte to its old building on the Boulevard de St. Germain in Paris, and has had to curtail its plans for publication. It is to be hoped, for the sake of geography, that these measures of economy will be merely temporary. Even our own Society is beginning to find its budget and its house too small for its needs. Wright's open record of the experience of a similar institution through hard and easy times embraces a study of difficulties which is worth the close attention of learned societies of all kinds.

The book is a rich source of information on the history of modern geography, but on one phase of the subject it will yield information only to the detective. Antagonism and tension are inherent in the world of learning where, of all

places, "Without Contraries is no progression." But, as to who were the stormy petrels of the society's voyage through time, Dr. Wright gives hardly a hint. This deprives us of part of our birth-right—appreciation of the drama in the growth of geographical knowledge. Those who did not know him will gain from this book but an incomplete idea of the character of the late W. M. Davis, for instance. Disagreement between masters is not necessarily to their discredit, and that between Dr. Bowman and Mr. A. R. Hinks did not prevent the American Geographical Society from awarding the Cullum Medal to Mr. Hinks (1943), nor our own Society from awarding the Patron's Medal (for 1941) to Dr. Bowman. Finally, in the gallery of excellent portraits illustrating the book, those who know the American Geographical Society will miss that of one person held in particular regard. M. AUROUSSEAU

TUDOR MAP ENGRAVERS

ENGRAVING IN ENGLAND IN THE SIXTEENTH AND SEVENTEENTH CENTURIES: a descriptive catalogue with introductions. By ARTHUR M. HIND. Part I: The Tudor Period. *Cambridge: University Press*, 1952. $9\frac{1}{4} \times 7$ *inches;* xxx + 333 *pages;* 157 *plates.* 6 *guineas*

THE ENGRAVER is a vital link in the diffusion of maps, and anyone who studies early printed maps must lean heavily on technical evidence relating to their engraving and reproduction. Dr. Hind's comprehensive catalogue, to be completed in three further parts, is of no less value to the historian of geography than to the art historian. In the Tudor period surveyed in this volume, the overlapping of these two fields of study is particularly marked. Of the thirty-three chapters in which Dr. Hind describes his material, all but five are concerned with engravers of maps or with geographical subjects.

For this coincidence (no mere chronological accident) both technical and historical reasons may be suggested. Dr. Hind remarks that "there are no primitives in English line-engraving," and this may be said also of English geography. The reigns of Mary and Elizabeth saw a parallel efflorescence of geographical thought and practice and of the craft of copperplate engraving in this country. Both geographers and engravers could build on the mature achievement of European scientists and craftsmen. For like reasons William Cuningham, who introduced his countrymen to the cosmographical ideas of Peter Apian, studied in the Rhineland, and John Shute, probably "the earliest native engraver whose name is known," in Italy. The work of the first English map engravers—Cole, Lyne, Ryther, Reynolds, Scatter—betrays their dependence on their Flemish tutors, principally (it appears) the Hogenbergs; and at the end of the century, exiles from the Netherlands, including Hondius, gave a new impetus to line-engraving in England. Thus the Elizabethan cartographers found ready to their hand the technique best adapted for reproducing their work.

In a clumsy but striking passage on the unity of the arts, quoted by Dr. Hind, Shute referred to "all the Mathematicalles which sciences and knowledges are frendes and a mainteyner of divers rationall artes" including that of the "Gravers"; and the affinity between geographers and engravers was not

merely a marriage of convenience. Both professions recruited their members from "expert artisans, or . . . sensible industrious practitioners," as Gabriel Harvey wrote, instancing "Humphrey Cole a Mathematicall Mechanician . . . John Shute an Architect, Robert Norman a Navigator, William Bourne a Gunner." The facility with which the makers of instruments for surgeons, for surveyors or for navigators turned their hand to engraving on copper is illustrated by Dr. Hind's chapters on Thomas Geminus, Cole, Thomas Hood (not noticed before as an engraver), and Charles Whitwell. The maturity of Cole's engraving technique in his map of the Holy Land (1572)—the earliest map signed by an English engraver—is very remarkable, the more so if this is in fact his only work in this medium. Noticeable too, though not mentioned by Dr. Hind, is the combination of the crafts of typefounding and map engraving, both of which were in this period practised by Frans Hogenberg, De Bry, Hondius, and Pieter van den Keere, while Cole was a "sinker of stamps" at the Mint.

Dr. Hind's catalogue is, as one would expect, a model of lucidity, order, and precision in description and reference. Generously illustrated by half-tone plates, it presents in convenient juxtaposition and compass a wealth of varied information. Its arrangement under engravers develops a coherent picture of the output and characteristics of individual workmen and workshops. This is especially useful in studying the relatively impersonal style of map plates. The student of maps must be the more grateful for the author's expert aid since (as Dr. Hind remarks) from Saxton's time "the publication of maps monopolized a considerable portion of the work of the engravers" and (as he might have added) cartographic material is a relatively sterile and unrewarding subject for the art historian. The map-engraver's merit is proportionate to his servility to his draft; original work, except in decoration and lettering, is absent; and the history of a map plate, in its successive states, must often be traced by wearisome collation of topographic detail and of innumerable place names.

Although he approaches geographical topics with suitable caution, Dr. Hind not unnaturally handles them with less assurance than the technical and historical matters within his own competence; and it may be suggested that some mistakes or omissions might have been repaired if the book had been read in proof by a geographer. The descriptions of maps are marked by occasional naïvety, *e.g.* the reference to "Wright's projection, an improvement on Mercator's" and the statement that "there is practically no indication" of Australia on the Molyneux globe. The Molyneux globes at Cassel are hardly a "recent discovery," since they were recorded in the nineteenth century and by E. L. Stevenson in 1921. By "the discoveries of Bernardt Langenes" we are to understand Houtman's voyage to the East Indies (1595–7); Langenes was in fact no traveller but the publisher of Houtman's journal. Dr. Hind remarks that "nothing is known" of Nicholas Reynolds, the engraver of Saxton's Hertfordshire; but manuscript charts by Reynolds survive at Dublin (1598) and Florence (1612). The Burghley atlas at the British Museum does not contain "the original drawings" of Saxton's maps; it is not an "original impression" but the manuscript draft of Norden's Hantshire that is to be found in B.M. Add. MS. 11, 853, and no impression from the plate in its first state is known. William Sanderson's arms are noticed on the Molyneux globes, but not on Norden's maps of Sussex and Hantshire. The R.G.S. copy of Symonson's Kent is not in the earliest state, of which no complete impression is known; and the anonymous "Shyre of Kent" after Saxton, of which the unique impression is in the Society's collection, is unnoticed by Dr. Hind. The only other serious omission seems to be Boazio's chart of the Atlantic, showing

Drake's tracks of 1585–6, and the four city plans published (in various states) in editions of Bigges's "Summarie and true discourse of Sir Frances Drakes West Indian voyage" from 1588. These five plates, tentatively attributed to Hondius by H. R. Wagner, are of special interest for their insets of reptiles and fish which P. H. Hulton of the British Museum has recently recognized as the earliest printed versions of John White's American drawings. Finally, we miss a discussion of the question whether map plates of atlas size were printed in England before 1600; in this connection, can the appearance of English printers' devices on Cole's map of the Holy Land (1572) and Lyne's large genealogical plate (1574) be considered significant?

These are petty blemishes in an impressive work of scholarship, launched (it may be added) seven years after its author retired at the age limit from government service and forty-seven years after he first trod this road in company with Sir Sidney Colvin.

R. A. SKELTON

REVIEWS

EUROPE

MONASTIC SITES FROM THE AIR. By DAVID KNOWLES and J. K. ST. JOSEPH. *Cambridge: The University Press*, 1952. $8\frac{1}{2} \times 11\frac{1}{4}$ *inches;* xxviii + 283 *pages; plans and* 130 *illustrations.* 55*s*

This book is the first published result of the action taken by the University of Cambridge in creating a Curatorship of Aerial Photography in 1948. Up to the outbreak of the Second World War the use of the new technique of aerial photography for the investigation of the earth's surface was still in its early stages. The greatest progress had been made in the field of archaeology where the pioneer work was almost entirely done by O. G. S. Crawford. But during the Second World War the armed forces of this country were forced to rely upon aerial reconnaissance for much of their knowledge about enemy dispositions and potentialities. So aerial photography came fully into its own, and another outcome of this crisis, upon which depends the existence of this book, was the beginning of the association of Dr. St. Joseph with the Air Ministry in connection with the development of its techniques. This contact was not ended by the peace, and every year since then Dr. St. Joseph has continued to carry out aerial reconnaissances over all parts of the country with Air Ministry support. The results over the whole field of archaeology and history have been spectacular, and Dr. St. Joseph's appointment to the new post at Cambridge has shown that the value of the technique is now fully recognized in the realm of learning.

The present book is the first of a series to be known as "Cambridge Air Surveys" and designed to deal with various aspects of Great Britain as seen from the air. As a medieval historian who has made English monasticism his special field Professor Knowles contributes an introduction in which he states the objectives which the authors set before them. He says "The collection of plates here presented is reproduced from air-photographs of the sites of medieval religious houses taken for this book. A very few illustrations of other medieval sites and of modern religious houses have been included for purposes

of comparison. It is hoped that a fairly ample collection of such views, including examples of almost every religious order in every part of the country—houses large and small, celebrated and almost unknown—may help to serve a number of purposes. It will, in the first place, illustrate the resources and potentialities of air photography as a technique applied to a particular field of archaeology. For the general reader or the tourist it may serve to give an idea of the wealth of such medieval sites existing in Great Britain, of the important architectural features that remain to be seen in so many places, and of the great natural beauty of so many of the sites. Those who have a more specialized interest, whether antiquarian, architectural, or purely historical, may be glad to find a large and representative selection of material grouped within the covers of a single moderately sized book."

Many of the sites illustrated in the book have already been excavated and their limits clearly defined, in most cases by the Ministry of Works. Here the air photograph gives a clear and comprehensive view of the site and its surroundings, while doing little to add to our knowledge of the plan. But in some cases, notably at Sempringham, Robertsbridge and Tilty, the air photograph brings out complex details of plan otherwise quite unknown through crop marks in cultivated fields or the parching of grass over buried foundations in summer.

To the archaeologist the most intriguing plates are Nos. 125 and 126, views of two sites of timber buildings of some complexity at Milfield and Yeavering near Wooler in Northumberland. They are included because they may have been early Christian churches, perhaps with monastic cells attached. Another possibility is that they may be Dark Age halls but, whichever is the truth, it is hoped that their skilled excavation will not be long delayed, for here is a chance to throw a ray of light into one of the darkest places in British archaeology.

This book fills a definite need, but the fact that special attention has been drawn in this review to some of the plates which give completely new information shows that, in general, the peculiar powers of air-photography in this field have not been drawn on heavily. But, with its accompanying text, it is a fine adjunct to the teaching and understanding of medieval history in Britain. The brilliance and technical skill of Dr. St. Joseph's photography is remarkable, and further instalments of this series will be awaited eagerly. With so many plates a high price is inevitable, but it is a pity that at fifty-five shillings the book cannot expect the wide distribution that it deserves. C. W. P.

MOURNE COUNTRY: landscape and life in South Down. By E. Estyn Evans. *Dundalk: Dundalgan Press*, 1951. 10×7 *inches;* viii+226 *pages; maps and illustrations.* 32*s* 6*d*

The area described in Professor Estyn Evans' book includes the Mourne mountains plus the south-eastern coastal strip forming the Kingdom of Mourne. Apart from its magnificent scenery and the interest of its geological history, this area is of great interest to the human geographer. Here a sturdy people has maintained itself as a close-knit rural community of small family farms in the face of movements which have led elsewhere to rural depopulation. This has been achieved by making the most of the resources of mountain, plain and sea. The book opens with chapters describing the geological history of this granite massif, and the processes of rock sculpture and erosion, and in particular the role of ice, in relation to the present landscape. Here the author is able to draw on recent research by Dr. Richey, Professor Charlesworth and others. These are followed by essays on the climate, archaeology and history. As readers of his 'Irish heritage' will know, Professor Evans is an informed and enthusiastic

student of rural life, and his chapters on the work and tools of farmers, quarry men and fishermen, and on many local crafts now rapidly disappearing, are full of illuminating details, which vividly recreate the social life of past and present. The maintenance of this way of life is difficult in present conditions, but as the author shows, not impossible. Though the age-old competition for the land continues, intensive methods of cultivation offer hope for the future, and the people preserve their independence of outlook, and instinct for cooperation. Intensive farming has brought the yield of potatoes to something like twice the average for Northern Ireland (most are sent to the mining towns of South Wales for "chips"), and a recent development has been a considerable export in seed potato. Bee keeping and the cultivation of soft fruits and vegetables are also recent innovations.

The book is well provided with sketch-maps, diagrams and drawings by the author, and by photographs. The colour photographs deserve a special mention. These are by Mr. H. G. Tempest, a member of the Dundalk firm which has produced them, and indeed the whole book, in excellent fashion. It will appeal not only to readers with some knowledge of the Mournes, but to all interested in regional geography in its widest interpretation. Few areas in the British Isles have been described so attractively. G. R. C.

ASIA

THE NORTHERN SEA ROUTE. By T. Armstrong. *Cambridge: University Press. Scott Polar Research Institute Special Publication No.* 1, 1952. 9½×6 *inches;* xiii+162 *pages; maps and illustrations.* 21*s*

Without a fluent knowledge of Russian, no author could have hoped to write a treatise on the Northern Sea Route. Nearly everything written on the subject has been in Russian. Of the 406 entries in Mr. Armstrong's bibliography, very few are in any other language, and even in Russian there are few, if any, comprehensive works. In the past this waterway was used during summer by Russian vessels, between the ports of Arctic Russia and the western Siberian rivers, but only by small vessels and it had no international significance. It was English vessels which first began its wider use, sixty to seventy years ago. Nordenskjöld's feat in 1878–79 in making the northeast passage in the *Vega* did little to draw attention to its economic value. But gradually, as the value of Siberian timber was realized, and bulky cargoes called for an outlet by water in place of the costly overland routes, which furs and gold could well stand, the waterway had a growing importance. The inevitable opening to trade of Siberia and other parts of central and northern Asia called for the use of the great navigable rivers which were linked by the Northern Sea Route. But an adequate survey of the coast line and channels was long deferred. As late as 1913, B. Vilkitski found an unknown group of islands (North Land) only 30 miles north of the Taimir Peninsula. Baron Toll in 1900 had said that from the Yenisei mouth to the Taimir Peninsula he was unable to find the position of his "*Sarja*" on any existing chart. During the First World War, the route was some use for carrying heavy goods to Siberia via the rivers, and something was done to improve the charts of the northern coast, but lack of prospective cargoes probably delayed the practical improvements and investigation of the route.

Intensive colonization of Siberia and the development of its resources was slow, and the demand for a sea route had to wait for scientific exploration of its waters and weather. Polar stations studying weather and ice movements were set up, and before the Soviet revolution there were six or eight, mainly

in the western end of the route. Latterly new charts and sailing directions have been issued. The stations are mainly meteorological, but most of them report also the movements of pack ice. There have been as many as eighty-seven coastal polar stations, but not all are continuously at work. They range from Spitsbergen (Barentsburg) and Franz Josef Land to the New Siberia Islands and eastern Siberia and Bering Strait. At many stations tidal and magnetic observations are made. Lighthouses and beacons have been erected, and icebreakers, of which the Soviet Union has a large number, are also used in this scientific work. Besides this, the Barents Sea is the scene of deep-sea hydrographic and fishery research.

In all these investigations, the Arctic Institute took a leading part. Mr. Armstrong gives an account of the route and then goes on to deal with the more economic aspects of the work, with details of many of the voyages. Besides weather and ice information, the successful use of the route depends on harbours, fuel supplies and cargoes requiring shipment, and it has in any case a short season. This route will be of value, not so much for through voyages between Pacific and Atlantic, except of a strategic nature, but rather as a link between the river routes and one or other of the oceans. Mr. Armstrong however refers to the hopes that the Northern Sea Route would provide an important alternative route to the interior of the continent, and observes that they have only been partially fulfilled. Only the Lena and the lesser rivers on either side of it appear to be used for trade with the far interior, although the Yenisei carries much timber for western Europe. From the strategic point of view it must be remembered that the route is flanked at its western end by excellent deep-water harbours not in Soviet hands. In Svalbard there are Russian coal mines, which are reported to have abundant accessible coal. Other coal is also reported on the route including the new worked Pechora coalfield that awaits a good port on the Kara Sea, and the probable coalfields of the Yenisei, Lena and Kolyma valleys. Some of these are inland. Oil is also reported in places. Salt is available for fisheries, and tin ore and graphite are of value. This book is a scholarly production packed with detail. Nothing that bears on the Arctic Route, scientific or economic, is omitted. Even statistics of shipping and cargoes, none too easy to obtain from Soviet sources, are added, and there are several good sketch-maps. The Scott Polar Research Institute makes a promising start for its Special Publications with this volume. R. N. R. B.

AFRICA

THE GAMBIA: The story of the ground-nut colony. By LADY SOUTHORN. *London: George Allen & Unwin, Ltd.*, 1952. $8\frac{1}{2} \times 5\frac{3}{4}$ *inches;* 283 *pages; map and illustrations.* 21*s*

Lady Southorn's account of the Gambia's past and present displays the same sympathetic insight and ease of description as marked her earlier works on Ceylon and Hong Kong.

The oldest, the smallest and the most unsophisticated of British dependencies on the mainland of Africa is a "geographic misfit," which is explicable only in the context of its history. Taking Sir John Gray's authoritative 'History of The Gambia' (1940) as a principal guide, Lady Southorn has woven a narrative which threads its way with an attractive lightness of touch through the events, some creditable, but too often sordid, of the past five hundred years.

Against this backcloth are presented vivid and fascinating descriptions of the "Great River," of the peoples who live on its banks, and of their environment

and daily lives. The book gives an informed commentary upon the more important aspects of the country's affairs: government, production, trade, health and education, without any shirking of the perplexities which confront so precariously balanced a community. No one who glances however superficially at the Gambia can ignore the disquieting fact that the country depends entirely upon one cash crop, ground-nuts, which represents 96–98 per cent. of its export trade. An unfortunate misquotation (on page 184) of the 1948 trade figures given in 'The Gambia—Colonial Report' for 1949 obscures this grim truth. £1,628,000 is the total value of shipments of ground-nuts, unshelled and shelled together; a mere £33,000 is the value of all other exports. The account of the successful production of ground-nuts under a peasant agricultural regime and of the organization for marketing the crop is of particular and topical interest at the present time.

This is in effect a handbook of the Gambia. There are perhaps as many ways of writing a colony handbook as of constructing tribal lays. Lady Southorn's method is to be highly commended; for she concentrates upon painting a picture of the more enduring features, the details of which can be enlarged from time to time as desired by the "hard" facts and statistics provided by annual reports and economic surveys.

An agreeable map and a competent index round off a useful and thoroughly readable book. The Peace of 1763 was of Paris, not of Ryswick (page 144).

H. B. T.

THE BASUTO. By HUGH ASHTON. *London: published for the International African Institute by the Oxford University Press*, 1952. $8\frac{1}{2} \times 5$ *inches;* xi + 355 *pages; map and illustrations.* 35*s*

THE MENDE OF SIERRA LEONE: a West African people in transition. By K. L. LITTLE. *London: Routledge and Kegan Paul*, 1951. $8\frac{1}{2} \times 5\frac{1}{2}$ *inches;* 307 *pages; maps and diagrams.* 28*s*

Much of our detailed knowledge of individual areas and peoples in Africa comes from the painstaking work of social anthropologists, and to such investigations we owe both of these recent studies. Geographers might wish for more about Basutoland, which lies in the heart of the Union of South Africa, and about Mendeland, which covers a large part of the southern half of the West African territory of Sierra Leone. But they will note with satisfaction how much information on agriculture, trade, land tenure and other such topics is here recorded for the first time or at least made readily available in an up-to-date study. Both books are especially readable because of the personal contact that the authors have had with the peoples of whom they write. This is particularly true of Dr. Ashton who has undoubtedly succeeded in his aim of writing "a straightforward and readable account of the Basuto way of life." From the excellent photographic frontispiece of a Mosuto looking over the lowlands to the final chapter on medicine, magic and sorcery, the Basuto are brought to life in a way that stimulates the reader even in those sections that are rather detailed and of less general interest. Dr. Little expresses his aim in almost identical terms and, as Professor Raymond Firth states in a preface, his ethnographic account of Mende society is comprehensive and has not followed the fashion in social anthropology that concentrates almost wholly upon single institutions or facets of a culture.

Professor Firth's preface recalls that Dr. E. B. Worthington wrote some years ago that research on African cultures as they are to-day, in a state of transition, is perhaps the most important need of African anthropological studies. These books show that this view is now widely shared, both authors

emphasizing the ways in which, and the speed by which, these societies are changing at the present time. The Basuto differ in many important respects from those of whom the great French missionary, Eugène Casalis, wrote some ninety years ago: and Dr. Little notes, especially in his final chapter, the importance of the modern social trend. He shows how much contact there is to-day between the Colony of Sierra Leone (with its dominant Creole element) and the Protectorate (where the Mendes are numerically the largest tribal group).

Dr. Ashton gives a concise historical introduction and an account of the social background of the Basuto before describing the lives and activities of the people in the village where he lived for several months. He gives information on the upbringing of children, marriage and funeral customs, and the chief occupations, and describes the political and judicial organization at some length, with reference to specific court cases. Repeatedly one is reminded of the influence of factors that are external to Basuto society: of the migration into the Union for employment (in farming and in mining) that results largely from the need to supplement inadequate incomes; or of missionary activity and Christian teaching that have been widespread for a century so that "practically everyone has some knowledge, no matter how garbled, of Christian doctrines, but the degree to which these doctrines have been accepted and the old ideas abandoned varies greatly." Throughout the book one is conscious of the effects of the proximity of the Union of South Africa, and of the extent of the contrast between traditional British policy in the administration of African peoples and the policies of successive Union governments, especially those of the present Nationalist administration. Consideration of such matters lies beyond the scope of this book. Dr. Ashton hardly goes beyond noting that the Basuto's desire for the stability and security of his country is "being greatly strengthened by the growing racial tension and animosities of Southern Africa." But it is these circumstances that make the publication of this volume by the International African Institute so topical and so especially valuable. In many respects this book is a model of its kind and it will help greatly to establish social anthropology as a study that has relevance to modern problems and to the future of African peoples.

Dr. Little's study may well have a similar effect, for he too is presenting a carefully drawn picture of a dynamic society that consists largely of rice farmers. A useful chapter summarizes the conditions under which rice is grown and the various problems of land-holding and inheritance. Other chapters discuss social organization and religious beliefs; marriage and the position of women; the importance of the chief; and modern methods of government. The part played by war in the development of the Mende is stressed: warfare in fact would seem to have been "a principal form of activity and institution" during the nineteenth century. Dr. Little also discusses the significance of the various secret societies, especially the *Poro*, for which this part of West Africa has long been noted. Collectively, he suggests, these societies provide (though with certain important differences) "an institutional structure which bears resemblance to the medieval church in Europe." But, like everything else in Sierra Leone, these things are changing to-day. Two world wars, the desire for a higher standard of living, political and constitutional developments within the country, the world's interest in Sierra Leone's palm kernels and diamonds—these and many other influences are causing rapid social changes and are creating new features and new stresses in traditional Mende society. Dr. Little believes that there are signs of a new social system in Mendeland. It is precisely because these signs are appearing everywhere

that there is such an urgent need for this recording of the facts of all African societies as they can be observed to-day. These two authors have done for the Basuto and the Mende what social anthropologists need to do for the many other African peoples that are equally in the stages of transition from one pattern of society and culture to another. R. W. S.

AFRICA SOUTH OF THE SAHARA. Edited by ANNE WELSH and prepared by a study group of the South African Institute of International Affairs. *London: Oxford University Press*, 1951. 9×6 *inches;* xxiv+286 *pages; maps and charts.* 25*s*

This valuable symposium is an assessment of the human and material resources of Africa south of the Sahara. In its implied emphasis upon the essential unity of the vast area treated it underlines a fact of growing importance. Its territorial boundaries are ignored by climatic distributions and by their associated types of natural vegetation, pests and diseases. Frontier lines are equally ineffective in preventing the spread of ideas, so that economic and political developments must diffuse their influences throughout its 134 million inhabitants. Western commerce, political theory and education have initiated developments in this rich and underpopulated continent whose future is of world concern. For here the white man must prove his goodwill towards the black, and western democracy demonstrate its superior spiritual, political and economic advantages over the dark dogmas of Communism.

A liberal attitude pervades those pages that deal with the aspirations of the evolving peoples of the continent, whose hopes must not be made to seem unattainable lest the revolt of desperation be engendered. The white man in the south cannot afford to be outdistanced by emancipatory actions over the rest, the far greater part, of Africa. Thus it is significant that this symposium should emanate from the Union of South Africa where relationships between white and black are now undergoing such anxious adjustments and where, born of hope and fear, the keenest interest is taken in African development. This book is therefore representative of only a particular viewpoint, namely that of liberal white South Africa. There is not a single contributor from the colonial services of Britain, France, Portugal or Belgium. Nor does an African write here on Africa!

The physical background is dealt with under chapters on climate, surface-features, water supply and vegetation. A map outlines the relationships between climate and the degree of suitability for European settlement based on criteria proposed by Sir David Brunt. There are also maps of rainfall, climatic and physiographic regions and vegetation. A series of temperature and humidity charts gives precision to certain of the climatic generalizations. The section dealing with the population and the political framework comprises an ethnic summary followed by a discussion on African reactions to Western political, economic and medical innovations. A map shows the distribution of certain tropical diseases. A chapter outlines how information and news are disseminated by press and radio. Agricultural production is treated under the major regions of natural vegetation with their respective chief crops, whose main areas of production are then described by more facts and figures. Livestock problems are related to climate, vegetation, diseases and to human factors. Maps illustrate the incidence of certain animal diseases and the distribution of cattle. A chapter on fisheries discusses how best to exploit and at the same time conserve marine resources. Forestry and timber are dealt with in the final chapter of this section.

The section on economic development summarizes the problems of this nascent enterprise such as the direction of African trade, regional differences in

wealth and the sources of power, raw materials and markets for mining and manufacturing industry. The final section deals with waterways, railways, roads, airways, harbours, telecommunications and broadcasting. Appendices give particulars regarding population statistics, constitutional structures, defence forces, agricultural production, harbour capacities and apparatus for both major and minor ports.

The twenty-six contributors to this volume have assembled much valuable material from a wide range of experience and a great variety of sources. The nature of this information and the manner of its presentation make this work of importance to geographers and to all who are interested in the problems of Africa. V. S. F.

AMERICA

CHILE. By GILBERT J. BUTLAND. *London and New York: Royal Institute of International Affairs*, 1951. 8×5 *inches;* vii+128 *pages; maps.* 12*s* 6*d*

URUGUAY. By GEORGE PENDLE. *London and New York: Royal Institute of International Affairs*, 1952. 8×5 *inches;* viii+100 *pages; maps.* 11*s* 6*d*

Both these volumes give a concise and reliable summary of the geography, economy, society and politics of the country concerned. Both provide copious and up-to-date statistics which are not otherwise readily accessible.

Mr. Butland is a geographer and his whole volume is informed by the geographical approach; this is especially necessary in the case of Chile with its strongly marked regional contrasts. He also brings out the country's dependence on mineral exports and on inefficient agriculture. Chile has an impressive system of social services (from which however the agricultural labourers are virtually excluded), but the death rate of 17·4 per 1000 (1948) is amongst the higher world figures. Uruguay, the only country in the Americas with a network of social services comparable to Chile's, has the strikingly lower figure of 9·4 (1942). The main explanation of this difference is that in Chile the effect of the social services is partly neutralized by low productivity and the resultant poverty.

Mr. Pendle writes with economy and elegance but in Mr. Butland's volume lapses of style are frequent. One infelicity out of many is the statement: "Ascending these fans eastward an occasional river is found." Both volumes have good indexes and excellent bibliographies. They will serve not only as sound introductions to the countries they describe but also as guides to further studies. Several other volumes on Latin American countries are to follow in this series. D. M. P.

GENERAL

DECORATIVE PRINTED MAPS OF THE FIFTEENTH TO EIGHTEENTH CENTURIES: a revised edition of 'Old Decorative Maps and Charts' by A. L. HUMPHREYS. With eighty-four reproductions and a new text by R. A. SKELTON. *London: Staples Press*, 1952. 12½×10 *inches;* viii+80 *pages;* 84 *plates.* 73*s* 6*d*

This is for all practical purposes an entirely new work. The introduction by Mr. Skelton, which replaces Humphreys' enthusiastic but not always well-informed essay, is an authoritative and welcome clarification of a subject upon which there has been much loose writing. The accompanying reproductions of maps do not include all those of the earlier edition, while others have been added.

Mr. Skelton is not concerned with maps as evidence for the advance of geographical knowledge or with methods of survey, though these aspects are treated to some extent in the annotations on the individual maps. His purpose is primarily the enlightenment of the collector, who is attracted by their aesthetic qualities and their interest as examples of the engraver's art. He describes clearly and succinctly the processes of engraving on wood and on copper, their scope and limitations, the development of national styles in design and ornament, and the changes which the blocks and plates underwent in their often surprisingly long lives. These facts, taken in conjunction with his account of the map and print trade, serve to explain what often puzzles the beginner, namely the persistence of identical or almost identical maps over a long period. The durability of the material, the ease with which plates could be altered, the large capital outlay which they represented, and the impetus behind established businesses, all contributed to what he calls the "conservatizing" influence of the copper plate. He quotes as an example Saxton's large map of England and Wales, first printed in 1583, and advertised for sale as late as 1795. Is it not possible that in this instance the map was being bought for its antiquarian interest, rather than for its practical utility?

The dating of such re-issues is often difficult, but the collector will find much assistance in this essay, with its discussion of characteristic styles, the use of watermarks, and the history of the great map-publishing houses. Its importance for the "historically minded geographer," as distinct from the collector, lies in its exposition of the way in which cartographical knowledge reached the general public, and for its emphasis on the extreme caution necessary when using these maps as historical evidence. The latter point is clearly put, and his words illustrate the first principle of research: "A map which shows New Zealand as two islands, separated by Cook Strait, must be later than Captain Cook's first voyage (1768–71); a map showing only the west coast, with no strait, must be later than Tasman (1642) but may be later than Cook." With the critical apparatus provided here, including the comprehensive bibliographies, the student should avoid many pitfalls.

A few points call for comment. In discussing the first modern printed map of England, reference might be made to the wood-cut map of the British Isles by Pietro Coppo, *c.* 1525, which has an interesting nomenclature, particularly for England. The reference to colour printing in the 1511 and 1513 editions of Ptolemy might have included the map of Alsace in the latter. N. S. Cruquius is stated to have been a French hydrographer, but he was in fact Dutch. This is perhaps of more importance than might appear, as it seems probable that submarine contours, which he is credited with inventing, were developed in the Netherlands. There is one general point which the reviewer feels is arguable. This is the assertion that a map "must somehow suggest the appearance of its subject as seen by the observer on the ground." This is surely to misconceive the purpose of the modern map. This is selective in the detail it includes, and is based upon a number of conventions, in the light of which it must be interpreted.

But to end on a note of criticism would be misleading. By keeping his objective clearly in view, the author handles a multitude of facts lucidly and in proper order. His lively comments make what is essentially a reference work thoroughly readable. The conclusions to be drawn from it, particularly its demonstration of the relations between medium, design and purpose, are valid for to-day. Their proper appreciation would put an end to the copying of archaic designs merely for the sake of their alleged quaintness. G. R. C.

THE OXFORD ATLAS. Edited by BRIG. SIR CLINTON LEWIS and COL. J. D. CAMPBELL with the assistance of D. P. BICKMORE and K. F. COOK. Revised impression. *Oxford: University Press*, 1952. $15\frac{1}{2} \times 10\frac{1}{2}$ *inches;* viii + 112 *pages of maps* + 90 *pages index.* 42*s*

The Oxford Atlas, which was reviewed on publication at some length in the *Journal* for December 1951, has since been twice reprinted. The last impression bears the note "Revised by Cartographic Department Clarendon Press and reprinted May 1952." We understand that this is not regarded as a new edition, but that it contains as much correction as could be made before a new printing.

The most considerable changes are the replacement of the map of the North Sea region by a physical map of the British Isles, and a new map of Africa on a larger scale. An inset map of southern Japan (1/5M) has also been added to plate 63, China and Japan. The physical map of Britain names many of the chief natural features. In one or two cases these might be more exactly placed, e.g. Norfolk Broads and Northampton Uplands. Some changes have been made in the colour printing of the relief. The green and the yellow are brighter, and the rather unpleasant reddish tinge of the brown has been modified. Except for the yellow, which tends to dominate the maps, this is in general an improvement. The main problem appears to be to find a suitable colour to lead from the green to the yellow; the bluish green used suggests a decrease rather than an increase in altitude. The registration is better, though on some plates it can still be improved.

The first five maps, covering the Polar regions and the Oceans, have been improved by introducing relief in colour on the land surfaces, by printing the names of ocean features in black instead of blue, and by showing the principal steamship routes in red. On most of the maps, corrections have largely been confined to the black plates. The map of England and Wales (1/1M) has been considerably revised, many names having been added, and the railways and routes augmented and corrected. For the somewhat clumsy and heavy black outlines of the great cities, lighter diagonal lines have been substituted, improving the general appearance. But it still seems arbitrary to end railway lines and roads on the outskirts, as in the case of Birmingham, as the conurbations then appear to have no centres. Around London, a number of large suburban boroughs are represented by the symbol for towns of 10–20,000 inhabitants.

Most of the suggestions made in the *Journal* review have been carried out, including those for improving the structure and population maps. The black plate for Belgium, for instance, has evidently been redrawn, and the map clarified by omitting French forms of names, previously given in brackets. The review brought an interesting letter from Dr. A. J. Pannekoek of the Netherlands Geological Service. He agrees in general with the comments on the map of the Netherlands, but points out that the review contains several errors in spelling. The names on p. 461 should read Schipbeek, Delfzijl, Gorkum and Gieten. He adds: "The name 'Gorkum' is not, however, an official one, but only a phonetic transcription of the pronunciation of the official name Gorinchem." He also points out that the river name printed as "Ijssel" on the map and "Ijsel" in the review, is properly written IJsel, the first two capital letters representing the old capital Y.

Reviewers in geographical periodicals, who are naturally interested in the maps of their particular countries, have suggested that proofs should be checked by experts in the various countries. Whether this is practical administratively is a question for the publishers. But at least with the benefit of the views already expressed, the anticipated new edition of the Oxford Atlas should attain an extremely high standard of execution. G. R. C.

SEAFARERS, SHIPS AND CARGOES. Edited by LEONARD BROOKS and R. H. DUCÉ. *London: University of London Press*, 1951. 8½×5½ *inches; 232 pages; maps, diagrams and illustrations.* 10*s* 6*d.*

Too little is generally known of the admirable work of the British Ship Adoption Society for whom this book has been edited by Leonard Brooks and R. H. Ducé. The purpose of the society is defined in the brief foreword—"The prime object of the Society is to encourage the association of schools with ships and those who man them, and thus to promote interest in, and knowledge of, ships, countries and overseas trade. Schools and ships maintain correspondence with each other, school pupils visit their adopted ships, and in these and other ways schools and ships gain very much from the close contacts and friendships which result."

The book comprises a series of letters written by the captain or ship's officer to the school of his adoption describing the many facets of seafaring in a merchantman. It may be a Levantine or a Baltic voyage, or it may be the antipodes or the Amazon; in simple graphic language the school is told the why and wherefore of merchant venture, and learns the lore of the sea and the way of life of the ship's company. The letters are illustrated with charts, drawings and photographs. To those who have ears to hear will come all the familiar sounds of a ship discharging her cargo or the mate letting-go the anchors, or of the pilot coming on board. You learn the principles of stowing cargo and the principles of navigation, you learn about ships' victualling and trade winds. Your horizons are widened by the descriptions of the ports visited and the countries along which the ship is coasting.

It is difficult to conceive of a more practical or imaginative way of securing a schoolboy's interest in seafaring and in the elements of economic geography than for a school to link itself with a ship through the good offices of the British Ship Adoption Society. In a postscript to the letters the editors state that at present about 900 schools make use of the adoption scheme. It is earnestly to be hoped that this service to schools can be greatly expanded; for the value of it cannot be overestimated, whether the aim is merely to teach geography or to inspire youth to go to sea in quest of merchant adventure.

In writing these letters so graphically and so humanly to the schools of their adoption, the ships' masters and other officers are performing a great service to the community; and for their part the editors are to be commended for compiling so purposeful and interesting a volume, which should be on the desk of every headmaster and geography teacher. There is a cheaper school edition at 8*s* 6*d.*

G. B.

HANDBOOK OF SUGGESTIONS ON THE TEACHING OF GEOGRAPHY. *Paris: U.N.E.S.C.O.*, 1951. 8½×5½ *inches; 104 pages; diagrams and illustrations.* 4*s*

This helpful and interesting booklet has resulted from an international seminar organized by the United Nations Educational, Scientific and Cultural Organization in Montreal in 1950. It is a summary and interpretation of the conclusions, made by N. V. Scarfe, formerly of the London Institute of Education. A first section on geography and international understanding approaches the matter in much the same way as another recent statement prepared for U.N.E.S.C.O. on 'Teaching for international understanding'—that a good course well taught will indirectly lead children "to appreciate and respect people of other countries . . . as human beings." The section on syllabuses and teaching methods contains valuable suggestions along lines on the whole familiar to progressive geography teachers in this country. The over-selective

syllabus is not favoured; "there is general agreement that by 15 or 16 years of age the adolescent should have acquired a minimum knowledge of most parts of the world" (the word minimum is perhaps a weak one). Activity methods receive useful advocacy; it is good to note that between "research" and "expression" some straightforward learning is rated as important. At all points the attitude of the teacher is rightly recognized as "of the utmost importance," and "the creation of sympathetic and imaginative understanding . . . is an essential part of the learning process." A fairly long section on aids to teaching follows orthodox lines, with due emphasis on outdoor study and visual material; a *caveat* on the deceptive inaccuracy of relief models is valuable here. An appendix describes the ideal geography room, the case for which is somewhat mildly made.

This is a useful and in parts a stimulating booklet which will be found helpful by most geography teachers, and with all or almost all of which most of them will agree. E. W. H. B.

LES FONDEMENTS DE LA GÉOGRAPHIE HUMAINE: Tome 3, L'habitat, conclusion générale. By MAX SORRE. *Paris: Librarie Armand Colin*, 1952. 10×6½ *inches;* 499 *pages; maps.* 1500 *fr.*

LA VILLE: le fait urbain à travers le monde. By PIERRE GEORGE. *Paris: Presses Universitaires de France*, 1952. 10×6½ *inches;* viii+399 *pages; maps and illustrations.* 1400 *fr.*

A man's book tells one something of its author, however guarded he may be in his statements, and it is appropriate that a trilogy on human geography should be written by one so appreciative of the world's varied civilizations, and so imaginatively aware of the problems of men and women in a variety of circumstances and at a variety of times. We study the works of men, Sorre tells us, so that we can know men: there is no rigid cycle of human development but only the possibility of evolutionary change. We use the term "habitat" in common with the ecologist, but without rigidity and in the knowledge that different groups of people have different traditions. To know something of the present one must also know the past: in France, at least, we are told, the relation of geography to history is well understood. As one reads Sorre's pages, three qualities emerge: the perception of the physical background, the understanding of a past that fuses into the present and an imaginative vision of the landscape as seen to-day. And one is impressed also by the inevitability of detailed regional study as background for such a book as this. The author has written his work, he freely admits, in days of disaster followed by to-morrows of fear, but he ends his trilogy with the hope that human geography may bring "to men of goodwill" enrichment of mind through "l'unité humaine—une unité morale immanente et respectueuse de la riche diversité des cultures." In other words, mankind is inevitably one, though the world has a rich diversity of civilizations.

Sorre is concerned mainly in this volume with population, and much of it is given to towns, as he rightly feels that the vast increase of town populations is one of the most significant phenomena of the age. The book has a thorough treatment also of "l'habitat rurale" and a chapter of special interest on the many transitional forms between the truly rural and the completely urban landscape: here attention is given to the districts of Belgium where the home linen industries have declined, but workers travel daily to the towns from their rural homes. This in turn is distinguished from the mining or industrial villages set in agricultural landscapes, such as those of the Franco-Belgian coalfield or, for that matter, several British coalfields. The definition of a town

offers difficulties. It cannot be merely statistical as different countries have their own standards. On page 180, Sorre defines a town as "a closed agglomeration, permanent, more or less densely peopled and closely built, largely or even entirely independent of its own land for its food, having (impliquant) in its life active relations with other areas and possessing from its very nature a high degree of internal organization" (free translation). Clearly conurbations and great international cities, such as Paris, London and New York, have their own type of life: clearly too, certain towns have special functions.

Much of Sorre's work on towns is of a general character and one turns to George for the specific: here towns are studied in relation to the civilizations of the people who make them. There are, for example, the ancient towns of Mediterranean Europe, the vast agricultural villages (towns in size and perhaps in function) of Hungary, the large commercial ports of South America, eloquent of the economic history of the republics, the North American cities, many of them of a mushroom growth that must, like the mushroom, eventually stop, and the "socialist" towns of lands behind the Iron Curtain. Many more types are distinguished, including such world centres as London, Paris or New York, of which the last has one million Jews, more Irish than Dublin, and more Italians than any city except Rome or Milan. Vienna figures too as a city having a tormented history; and the military, industrial and commercial cities of Japan, some of them welded, like Tokyo and Yokohama, into great conurbations, are also discussed. George's treatment of the Soviet towns is of particular interest and he appears to admire the residential quarters which he says "sont équivalents" for all, and the aggregate of public buildings set (ideally) in a park at the centre. Warsaw, it seems, having had 85 per cent. of its property destroyed with the loss of 800,000 lives, must be rebuilt on similar lines as "the rational capital of a democracy." Unfortunately, little attention is given to small towns: for France the map of towns (page 74) includes none of less than 10,000 people, with the result that as much as 100 kilometres appears to separate one town from another. One misses here a study of the small towns used by the farmers week by week.

George, like Sorre, paints on a large canvas. It is a tribute to his work to say that its readers will realize how much more there is to do on towns, for any reasonably minded author wishes others to write also. George, like Sorre, is easy to read and clear in expression. But why have both authors so few maps in their text? One admires the skill with which they describe places, many of which are hard to describe, but George has only twenty-five maps and Sorre thirty-two. And on occasion the standard of the maps is below that of the text. George's map of London (pages 168–9) includes among its suburbs "Levton" and Stafford, and has a wealthy residential area around King's Cross and Euston. The "quartiers de classe moyenne (maison à étages)" cover, it seems, almost all the county of London south of the river. George was charmed by what he saw "dans West-End" but comments "point de cafés à Londres, mais de fréquent tea-shops." The deficiencies of the London map should perhaps leave one with the thought that more work is needed on the types of land use to be found in towns and cities. T. W. F.

PORTS AND HARBOURS. By F. W. MORGAN. *London: Hutchinson*, 1952. $7\frac{1}{2} \times 5$ *inches;* xi+165 *pages; maps and diagrams.* 8*s* 6*d*

This is a very straightforward statement which keeps within pretty clearly defined lines. It will serve as a simple and reliable introduction to a large and frequently complex aspect of economic geography. After an introduction which is both a matter of definition and a suggestion of range of subject matter,

the author passes to an examination of the harbour and of the port, being at pains to emphasize the significance of the physical background and the means and processes of adaptation to it. One short chapter discusses the by no means simple business of classification of ports and then follows a section devoted to the closer study of two of the functional types listed, making it possible for there to be some reference to certain aspects of ocean-borne trade. The problem of hinterlands is presented in clear and precise outlines while the final chapters deal with the growth of industry in ports and the history of ports.

So wide a range of topics can but receive outline treatment within the space of some 150 pages. The author has fulfilled his task in a satisfactory manner but it may be that his presentation is so clear, so well illustrated and with examples so carefully selected that the young geographer for example may not quite realize how much lies behind this study and how difficult some features of this work can be. But if the reader turns to some of the works listed in the bibliography, or attempts the history of an individual port, or tries to cope with the port statistics of this and of most other countries, he will rapidly discover why the International Geographical Union agreed to establish a Commission on Industrial Ports. The preliminary report of the Commission, to which Mr. Morgan contributed shortly before his untimely death, has recently appeared and it is most opportune that his introductory study should be available at this time. G. H. J. D.

SOME RECENT TRAVEL BOOKS

Vivid and sympathetic accounts of the peoples and animals of India are seemingly rare, but Jim Corbett in a short book (MY INDIA, *Oxford University Press*, 10*s* 6*d*) writes with a real love and understanding of the villagers of the Naini Tal and Mokameh Ghat regions in the United Provinces, among whom he lived and worked during the greater part of his life. Indeed, it would be difficult to find a more illuminating description of Indian village folk than that contained in these few pages, and it is a pleasant experience to read a book so well written by someone who has lived long enough in India to have dropped all patronizing attitudes to its people. There is a delightful undercurrent of folk and animal lore and a host of miscellaneous and interesting pieces of information such as the statements that two-year-old bamboos are best for basket-making, and that small hospitals in India do not provide either food or attendants for the patients. One mild criticism: a short glossary might well have been included, for though he may be familiar with such words as *dacoit* and *nullah*, the western reader who has never been to India may be puzzled by *machan*, *bania* and *kakar*.

In contrast, Mr. Peter Scott's WILD GEESE AND ESKIMOS (*Country Life*, 21*s*) offers a complete change of climate and people, though the author, like Corbett, writes with great enthusiasm. This book is a journal of the author's Perry River expedition in 1949, and its diary form enables the reader to share fully the adventures of the journey to this region of Arctic Canada. The object of the expedition was to obtain information about certain species of waterfowl threatened with early extinction unless protective measures are immediately undertaken. Among these birds are Ross's Geese which, according to the author, number no more than five thousand in the world, and probably much less. The ornithologist will find plenty to interest him in this book, but there is also much detailed information about the Eskimos and their way of life. The book is

pleasantly illustrated by Paul Quenau's photographs and by the author's black-and-white sketches.

And now the South. Mr. L. Harrison Matthews gives a breezy description of adventures among the albatrosses and petrels of South Georgia in his WANDERING ALBATROSS (*Macgibbon & Kee* with *Reinhardt & Evans*, 15*s*). This bird-life is well described, while a vivid impression is given of the icy mountains, the fogs, and the sharp squalls of the Southern Ocean. For those who like a good salty yarn garnished with occasional ornithology and frequent cries of "Skaal," this is the book. There are excellent photographs of the birds, and lively black-and-white sketches for chapter-headings, done by the author.

The last two works to be mentioned are both about South America, the first being the fruit of scientific researches in the Venezuelan Andes, the second an account of a biological expedition to the little-known region between the Andes and the Amazon. Dr. William Beebe is a great naturalist and a practised writer, and in his HIGH JUNGLE (*The Bodley Head*, 21*s*) there is a wealth of observation on the natural history of tropical American jungles, for the most part gathered during three expeditions centred on the author's Rancho Grande laboratory up in the coastal Andes in the Aragua National Park. The book may be a shade too crammed with facts for the general reader, but Dr. Beebe is never dull. There are a number of remarkable photographs—those of the battling rhinoceros-beetles, for example—and two appendices, on one giving the scientific names of animals mentioned in the text, and the second listing the scientific papers by the author and others concerned in the Venezuelan expeditions.

In THE IMMACULATE FOREST (*Hutchinson*, 18*s*) Dr. W. R. Philipson has written an admirably objective description of a tropical forest. This competent, straightforward account of a biological expedition to the Macarena Mountains in Colombia is full of interest, and every chapter provokes thought. The expedition had been inspired by the theory that these mountains are the remnants of a great sandstone plateau which once stretched right across the whole of South America. During the last two or three days of the trip a small fern was found linking the Macarena Mountains with the mountains of Guiana, and another fern was found, known previously only from the State of Piauhy, a region of Brazil separated from the Macarena Mountains by 2200 miles. Again, Dr. Philipson, in describing the vegetation above the tree-line in the Andes and noting the plants belonging to the genus *Espeletia*, remarks that in high and desolate places some plants seem to run to size, and suggests that this gigantism is due, not to the altitude itself, but rather to some factor of the severe climate. He instances the gigantic groundsels of the mountains of tropical Africa, and the huge Kerguellan Cabbage on the desolate sub-Antarctic Kerguellan Island, mid-way between South Africa and Australia. But it matters little at what page you open this book: it is full of interest. For the arm-chair traveller there is an account of the hazards provided by electric eels, sting-rays, caimans and jaguars. The latter rarely showed themselves, and the author did not see a living specimen, though he relates a breath-taking story of being followed by a jaguar along a trail. There is also a chapter on a flight to the Amazon which the author and his British colleague on the expedition, Christopher Doncaster, took from Bogotà to Leticia, and the book ends with a general summing-up in which the outstanding botanical and zoological achievements of the trip are briefly recalled.

A. C. T.

THE SOCIETY'S NEWS

APPLICATIONS FOR GRANTS FOR EXPLORATION AND RESEARCH, 1953

Applications for grants must reach the Director and Secretary not later than **1 March 1953**; it is only in very exceptional circumstances that late applications can be considered. Applicants should state (*a*) their scheme of research or scientific programme; (*b*) the names, number and qualifications of members of the party; (*c*) length of time to be spent in the field; (*d*) total estimated cost; (*e*) names of other institutions to which they have applied for help; (*f*) the amount of the grant, and any other assistance, that they request. Applications should be accompanied by two letters from qualified institutions or individuals supporting the proposed expedition of research. *All applications must be typed.* Leaders of expeditions and applicants for grants will be expected to attend an interviewing board.

BRITISH EVEREST EXPEDITION, 1953

On October 8 the Joint Himalayan Committee of the Society and the Alpine Club, which is immediately responsible for sponsoring the 1953 Everest Expedition, nominated Colonel H. J. C. Hunt, C.B.E., D.S.O., as leader of the Expedition following on the resignation of Mr. Eric Shipton. Colonel Hunt, who has been specially released by the War Office to organize and lead the party, has had a distinguished career as a mountaineer in both the Alps and in the Himalaya. In 1935 he was a member of an expedition to K 36 in the Karakoram and reached a height of 24,500 feet and he made the first ascent of the South Face of Kolahoi, Kashmir, in the same year. In the following year he led an expedition to Sikkim and made the first ascent of the Nepal Peak, 23,700 feet. He has had in all ten Alpine seasons and on two of his three Himalayan expeditions he was the leader. The Expedition plans to leave this country in February.

THE RECORD

CONTRIBUTORS TO THIS ISSUE OF THE *JOURNAL*

Professor *O. H. K. Spate* was formerly Reader in Geography at The London School of Economics, and is now Professor of Geography in the School of Pacific Studies, Australian National University, Canberra. *H. R. Wilkinson* is Lecturer in Geography at the University of Liverpool; has visited Jugoslavia on a number of occasions since the war; is now engaged in research on the historical and political geography of the Balkan Peninsula, Dr. *W. G. V. Balchin* is a Lecturer in Geography at King's College, London, and has contributed papers to the *Journal* dealing with the physical geography of parts of Cornwall, Kent and Spitsbergen. *G. W. Murray* was for many years Director of the Topographical Survey of Egypt, and is one of the Society's Gold Medallists. Dr. *H. F. P. Herdman*, originally on the scientific staff of the Discovery Committee, Colonial Office, is now Principal Scientific Officer, Royal Naval Scientific Service, seconded to the National Institute of Oceanography. *M. Aurousseau* has been Secretary of the Permanent Committee on

Geographical Names since 1937, and was awarded the Society's Cuthbert Peek Grant in 1941. Miss *Eila M. J. Campbell* is a lecturer in geography at Birkbeck College, London; in 1949 she was invited to be the first holder of a Research Fellowship inaugurated that year by the New Zealand Federation of University Women.

THE CENTENNIAL CELEBRATIONS OF THE AMERICAN GEOGRAPHICAL SOCIETY

The American Geographical Society celebrated its Centenary from August 4 to 6, immediately before the Congress of the International Geographical Union which was held in Washington D.C. The nearness of the Congress dates made it possible for a large number of foreign delegates to attend the Centenary celebrations in New York, where the Society's headquarters are located. The largest national group from overseas was that from the United Kingdom.

The chief event at the Centenary was the meeting held in the Auditorium of the American Academy of Art and Letters to welcome visitors and to make the award of medals. The distinguished President of the Society, Dr. R. W. Light, presided. The recipients of the medals were Mr. J. M. Wordie, President of the Royal Geographical Society (the Charles P. Daly medal); Dr. Gilbert Grosvenor, President of the National Geographical Society (the Samuel Finley Breese Morse Medal); Dr. Roberto Almagià, Professor of Geography in the University of Rome (The Cullum Medal); Dr. Carlos Delgado de Carvalho, Professor of History in the University of Brazil (The David Livingstone Medal); and Dr. George B. Cressey, President of the International Geographical Union (The Davidson Medal).

The remainder of the Centenary arrangements included a reception, a garden party, visits to the Rockefeller Centre and Radio City, and a number of well-planned visits to various parts of Manhattan Island and its environs. At all of these activities those participating were guests of the Society. One incident of special interest to members of the Royal Geographical Society was the presentation of an address of congratulation on behalf of the Council and Fellows. The address, which bore the Society's seal, was signed by the President, the Honorary Secretaries, and the Director and Secretary; it was very beautifully written on vellum by the Society's own draughtsmen, and was presented by Mr. Wordie and Mr. Brooks who were the Society's representatives at the Centenary.

The President and the officers of the American Geographical Society are to be warmly congratulated upon the arrangements for the celebration, and upon the cheerful and happy spirit which pervaded the whole meeting. L. B.

CONGRESS OF ONOMASTIC SCIENCES

The Fourth International Congress was held at Uppsala, Sweden, from 18 to 21 August 1952. About 250 delegates assembled from twenty-five countries to discuss the study of names, and particularly of personal names and place-names, in the lecture-rooms of the University of Uppsala. The occasion marked the Jubilee of Svenska Kungliga Ortnamnskommissionen, the Royal Swedish Place-name Commission, and the Congress was held under the patronage of H.M. the King of Sweden. Over fifty papers were read, some of them of high geographical interest, but no particular aspect of onomastics came in for special attention. At the Jubilee Celebrations, held on the afternoon of August 21, addresses of congratulation were read from Governments and Academies in various parts of the world, including one from Her Majesty's Government. The whole Congress was taken on a motor tour through the province of Uppland on August 19, under the leadership of Dr. Jöran Sahlgren,

Director of Svenska Ortnamnsarkivet, the headquarters of the Royal Place-name Commission. The most interesting feature of the tour was the number of well-preserved rune stones to be seen in the region, some of them still serving the purpose for which they were originally set up, as, for instance, the commemoration of the building of small bridges that are still in use. Delegates were entertained at a dinner given by Kungl. Gustav Adolfs Akademien, and at a banquet given by the organizing authorities of the Congress in the Rikssal of the Castle of Uppsala. The Congress resolved that, in its publications, and in those of the International Centre of Onomastics (Louvain), none but the official spellings of the names of places which are officially written in forms of the Roman alphabet, will be used. This is merely a re-affirmation of a resolution originally passed by the International Geographical Union in 1872 and approved by the International Map Committee in 1909 and 1913 and by the International Hydrographic Conferences of 1919, 1926 and 1929, but it represents the greatest measure of international agreement on the spelling of geographical names so far attained. Its repetition by the Congress, and its acceptance by the International Centre of Onomastics, is timely. It was also decided that the Fifth Congress be held at Salamanca in 1955. A short account of the Third Congress (of Toponymy and Anthroponymy) is to be found in the *Journal* (114 (1949) 226) and one of the foundation of the International Centre of Onomastics in 118 (1952) 238–9. M. A.

SCHOLARSHIPS IN GEOGRAPHY AT OXFORD

A short note in the *Journal* (116 (1951) 237) gave incomplete particulars of Scholarships in Geography at Oxford in 1951. Full details of all emoluments at Oxford are printed annually in special numbers of the *University Gazette* in July each year. The relevant numbers for the year 1952–53 are No. 2747 (price 1*s*) for men, and No. 2749 (price 3*d*) for women. Emoluments for Geography are offered at Jesus College and St. Edmunds Hall; for Modern Subjects, including Geography, at University and Balliol Colleges, New College, Magdalen and Corpus Christi Colleges; and for certain closed emoluments at other Colleges (*e.g.* King Charles I Scholarships and Exhibitions at Exeter, Jesus and Pembroke Colleges, and Heath Harrison Exhibitions at Brasenose College). Hertford College offers a Scholarship every three years; the last offer was made in 1951. Emoluments for Geography are offered at all the women's Colleges, where there is a combined Scholarship and entrance examination.

J. N. L. B.

NEW PLACE NAMES IN CENTRAL VESTSPITSBERGEN

On the eve of publication of the Cambridge Spitsbergen Expedition's map of Central Vestspitsbergen, in the September issue of the *Journal*, word came through that the following names had been accepted by the Norsk Polarinstitutt. It was possible to include the following eight on the map but none of them could be listed in the appendix.

	Lat.	*Long.*
Grantabreen ..	79° 02′	16° 50′
Keplerbreen ..	78° 56′	17° 30′
Merkurfjellet ..	79° 02′	17° 00′
Oberonhamaren ..	78° 50′	17° 14′
Phoebefjellet ..	78° 56′	17° 24′
Planetbreen ..	79° 02′	17° 05′
Tethysfjellet ..	78° 55′	17° 25′
Titanfjellet ..	78° 55′	17° 24′

The positions of those not shown on the map are described in more detail as follows:

	Approx. positions *Lat.*	*Long.*	
Arielhamaren ..	78° 49′	17° 02′	Cliffs of western promontory between Conwayjøkelen and Sedgwickjøkelen.
Bertrambreen ..	78° 45′	16° 38′	Glacier overhanging Ebbabreen between Pukkelkammen and Sporehögda.
Einsteinodden ..	79° 03′	16° 19′	Rocky headland S.W. of Einsteinfjellet.
Gneisodden ..	78° 58′	16° 23′	Smooth rock ridge to seaward of N. moraine of Stubendorffbreen.
Granatodden ..	99° 00′	16° 22′	Rocky promontory W. of Lemströmfjellet and just N. of lagoon. A trapper's hut is situated S.E. of this lagoon and is incorrectly shown on the map.
Helsinkibreen ..	78° 58′	16° 50′	Tributary of Stubendorffbreen between Snøkuppelen to N. and Bleikfjellet and Malmgrenfjellet to S.
Kapp Murdoch ..	78° 26′	17° 06′	Small cape S.E. of hut, E. of Fuhrmeisterdalen.
Kometbreen ..	79° 01′	17° 00′	Tributary of Stubendorffbreen between Merkurfjellet and Eddingtonryggen.
Lynkammen ..	78° 57′	17° 03′	Ridge extending S. from Tordenryggen to junction of Fantastiquebreen and Formidablebreen.
Pruvostbreen ..	79° 04′	16° 47′	Tributary of Smutsbreen; between Westbyfjellet to N. and Jelstrupfjellet and Størmerfjellet to S.
Smutsdalen ..	79° 02′	16° 24′	Wide valley running due W. from Smutsbreen.
Stormbreen ..	78° 57′	17° 06′	N. tributary of Fantastiquebreen; due W. of Eroshetta.
Stuttbreen	79° 00′	17° 15′	Broad N. tributary of Harkerbreen between Eddingtonryggen, Didierfjellet and Waynfletefjellet; adjoining Veteranen to N. and Kvitbreen to E.
Titaniahamaren ..	78° 48′	17° 07′	Cliffs flanking N. of Sedgwickjøkelen; between Arielhamaren and Oberonhamaren.
Tordenryggen ..	78° 58′	17° 00′	Range flanking Harkerbreen to S.E. between Snøkuppelen and Eroshetta.

Kapp Murdoch appears on a sketch-map by Feyling-Hanssen and Jørstad (Norsk Polarinstitutt Skrifter No. 94, 1950). The other names have arisen out of the work of the Cambridge Spitsbergen Expedition 1949 and the Oxford and Cambridge Spitsbergen Expedition 1951, and are printed here for the first time. Thanks are again due to Dr. Orvin of the Norsk Polarinstitutt for considering these names. Full details of each place will eventually be published by the Norsk Polarinstitutt. W. B. H.

RESEARCH ON ARID ZONES

A symposium on "The Biology and Productivity of Hot and Cold Deserts," arranged by the Institute of Biology, was held in the rooms of The Royal Institution on 25, 26 and 27 September 1952. The Symposium was opened by the President of the Institute, Dr. Edward Hindle, F.R.S. (Hon. Secretary of the Society) who referred to the special importance of arid zone research in view of the present food position in the world. He pointed out that in many parts of the globe, whilst the population is increasing, the amount of land stays constant or actually declines as a result of erosion or other forms of soil deterioration. The reclamation of arid zones offers one of the best methods of alleviating land shortage in the world as a whole, and therefore it was desirable to have as much information as possible on the practicability of utilizing subterranean waters and the general conditions governing the physical aspects of deserts. It was also essential to determine the suitability of useful plants for growing under arid or semi-arid conditions and the physiology and ecology of desert animals.

The first session was devoted to the Climate and Physical Environment and comprised four papers on the subject. The Geography of Deserts by Professor F. Debenham, was communicated by Brigadier R. A. Bagnold, F.R.S., in the absence of the author. The following is a summary of his communication:

The distribution of deserts is mainly due to the circulation of the atmosphere, particularly as to its lower layers, whereby certain areas of land are starved of moisture. The variability of desert rainfall and its capricious choice of locality are important factors in the economy of arid regions, since they involve the ability to migrate in all the larger animals, including the domestic group. It is clear that the fraction of storm-rain which penetrates the soil, to be conserved or seep away to other areas, is a vital figure; but it is one on which we have few observations.

The hydrology of deserts consists therefore of finding out not only what is the effective rainfall but where it goes to. The importance of the ecologist in this research has probably been underestimated, and much useful information may come from a careful study of indicator plants—that is, trees and shrubs which can survive long periods of drought.

Brigadier R. A. Bagnold then gave an account of "The Physical Aspects of Dry Deserts." He stated that the great regions of dry desert were due to geophysical causes and therefore inevitable. Their primary characteristic is drought; but the degree of drought is not measurable in terms of mean annual rainfall alone. The factors affecting biological availability of desert moisture are (1) Reliable outside or artesian ground water supply. (2) Factors introduced by surface relief, soil and geology, causing variations from place to place. (3) The frequency and duration of cloud associated with rain. (4) The precariousness of rain, its variation from year to year and the frequency of rainfall.

Whilst rain may be very infrequent at any one place in a desert area, it may fall at different places in different years and thus the periods between occasional grazing can be much reduced by moving from one locality to another. If rain falls up wind, animals can scent it. If down wind, information is usually passed by word of mouth and natives may walk up to 150 kilometres to see if rain has fallen. Nomadism in this sense carries a limited productivity into vast areas totally unproductive by any other system. It is estimated that over much of the Libyan desert in Neolithic times an increase of only 24 millimetres per year above the present rainfall, enabled general nomadism to be possible.

Professor F. W. Shotton then discussed the "Availability of Underground Waters" which in hot deserts is limited by considerations of quality and quantity. Experience has shown that very good quality water derived from the

normal water table fed by such rain as does fall in deserts, is almost always too mineralized for use.

Therefore in all great desert areas the only hope of large supplies of good quality water lies in the possibility of deep aquifers, insulated from the saline local waters and having large intakes in rainy areas beyond the desert.

The general conclusion would appear to be that although in semi-desert areas (*e.g.* South Palestine) considerable development of underground water can still be hoped for, the prospects for the greater part of the true deserts must always be poor.

The "Bioclimatic Conditions in the Egyptian Desert" were described by Dr. C. B. Williams, who had made studies of the microclimatic conditions in the neighbourhood of Cairo. Curves illustrated the great variation between localities only a few feet apart. The daily range was however rapidly reduced inside caves, down to only 2° C. at 12 metres from the entrance, and the difference between the cave temperatures in August and December was also only 2° C. The relative humidity exceeded 75 per cent. on all nights except one in August, and dew was found on plants on the plateau but not in the valley.

Dr. S. M. Manton, F.R.S., gave an account of "Biological Research and the Productive Transformation of Steppe and Desert in the Soviet Union," based on a visit there in 1952. The development schemes now in progress provide for the irrigation of 70 million acres of steppe and desert in Central Asia and the Ukraine by 1957. The paper included a description of the biological research associated with the construction of the Turkmenian Canal and the productive development of the Kara Kum desert. E. H.

IRISH GEOGRAPHY

Several important contributions to the regional geography of Ireland are made in an issue of *Irish Geography*,[1] which is published annually under the editorship of A. Farrington, Secretary to the Royal Irish Academy. A reading of the articles leaves one in a somewhat depressed state of mind, as their writers make it clear that some of the towns studied are dreary and decaying, and that in a world of food shortage countrysides are farmed inefficiently. These writers on the social and economic aspects of geography have a realistic approach to the problems with which they deal: they do not idealize the "peasant" as a romantic figure having a way of life in which material things are of little account.

Three papers deal with geomorphological subjects. One of these, by J. C. Coleman, deals with a number of caves near Carrickmacross, Co. Monaghan: Mr. Coleman, an active speleologist who has already contributed several papers[2] on Irish caves and underground watercourses to journals, here describes the results of field work in a district where Carboniferous limestone is practically covered with drumlins . . . "the drainage is indefinite and small lakes are numerous, some of which have subterranean discharge channels." A. Farrington, in a short paper on the Slieve Bernagh, a range to the west of the Shannon, describes two distinct types of drift found there, and F. M. Synge, now of Aberdeen University but formerly a research student at Trinity College, Dublin, has attempted a correlation of the major terminal moraines of Ireland with those of Great Britain. Like many more papers on glaciology, this one asks as well as answers questions, but it contains the interesting suggestion that

[1] *Irish Geography*, 2 no. 4 (1952), 3*s*. Available on application to the Hon. Secretary, J. A. K. Grahame, c/o Department of Geography, Trinity College, Dublin.

[2] *Irish Geography*, 2 no. 2 (1950) 60.

the vast drumlin belt of Ireland "may be indicative of an ice-sheet decaying *in situ*."

At various times in its history Ireland has received invaders and peaceful settlers: Helmut Blüme, in an article on the Palatine settlement, deals with a group of peaceful settlers. Some three thousand Palatines came to Ireland in 1709 by official invitation, but only about one thousand stayed. These settled in groups in Co. Limerick, and were recognized as a distinct element in the population by Arthur Young in 1778, and by various nineteenth century travellers. Their farming practices, housing, barns and stables were said to be superior to those of the neighbours, but the Irish did not profit by the good example—there is even evidence that they resented it. For generations the Palatine farmers grew a wider range of crops than the Irish, but by the twentieth century they adopted the cattle farming that became characteristic of Co. Limerick and they were no longer a distinctive group. H. C. Brookfield, of Birkbeck College, London, has given us an informative article on Cobh (Cove) and Passage West, two towns on Cork harbour. The long ramifying inlets of this fine harbour were fortified at the end of the eighteenth century and the British Navy established themselves here firmly during the French wars. Both towns prospered as sea bathing places and in time Cork harbour was full of shipping, some of which consisted of emigrant boats for America and even Australia. But when the river was deepened to Cork, Passage West lost its trade; Cobh had a varied career as a town but never sank to the destitution of Passage West, where for more than half a mile along the river there are ruined buildings and wharves, with a harbour no longer usable. And as a final bizarre element there is the abandoned but minaret-crowned Royal Victoria Hotel. It is unfortunate that so little is pulled down in Ireland once erected. With some justice, Mr. Brookfield comments that there is clear evidence of the effect of changes in technology and social habits on the growth and decay of towns.

Change and decay also figures as a motif in two other articles, one on Tory island, off the north-west coast of Co. Donegal, by H. G. Williams, and another on Killaloe and district, by J. P. Haughton, Lecturer in Geography in the University of Dublin. Mr. Williams shows that the islanders of Tory have long since used all their peat and "import" it from the mainland: they no longer raise all their own food, nor do they manufacture their own clothing. They have four main sources of income—agriculture, fishing, seasonal migration to Britain as labourers and the use of flotsam from wrecks. One by one the islands off the west coast of Ireland are deserted and, says Mr. Williams, "Tory island seems to have only a short time left . . . as an inhabited place." Killaloe, on the Shannon, is a small Cathedral "town" having some nine hundred people: to the west, in the Slieve Bernagh range, there are farms so poor that many of their holders are being moved under government schemes to new holdings in Co. Meath and Co. Kildare. The author shows that many of the farms are unlikely to be taken by a family once the present holders die: the holders consist mainly of old couples whose families have emigrated, or of an old bachelor and his sister. It is hard to resist the impression that farming is inefficient: there is a creamery near Killaloe, but it takes a whole morning for the farmer to reach it and return home. Killaloe is a quiet place having monthly stock fairs but at other times its trade lies in its forty-odd shops of which fifteen are also public-houses. An incongruous but valued addition to the town is a cardboard box factory established here in 1938.

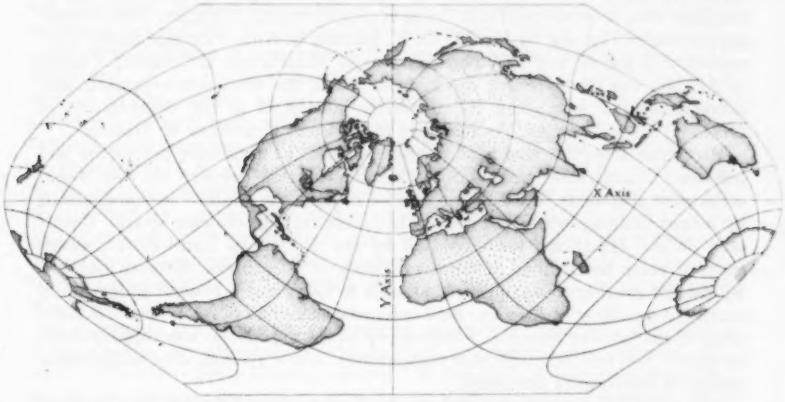
The merit of the articles in this number of *Irish Geography* lies in their close touch with the field. The work on glaciation and underground watercourses is clearly of significance in a country where one of the main agricultural problems

is drainage and so a contribution is made to regional geography as well as to geomorphology. Similarly the other studies carry the mind's eye to the landscape of a country where changes in land use, both in towns and rural areas, have been marked. Most readers of these papers will feel that improvements might be made with advantage in both town and country, but the evidence provided in these fieldwork studies has social implications too large to discuss here. And very wisely the authors leave their articles to speak for themselves.

T. W. F.

A NEW NET FOR A WORLD MAP

This note is supplementary to that by the late Professor C. B. Fawcett which appeared in the *Journal* of September 1949. The article mentions the poster of the Empire Marketing Board, the original draft of which I helped to produce. The idea of placing the British Isles in the centre of the land areas of the world should presumably be accredited to Sir Halford Mackinder, but the artist's



decision to place the map into a semi-circular frame was an arbitrary one. The projection which appears with this note might, as Professor Steers suggests, be called Pseudo-Cylindrical, as it is a mean between the Plate Carée and the Sinusoidal.

The x axis is an oblique great circle, and from it the poles are situated at a distance of 35°. Therefore if an azimuth and distance table is available for latitude 35° we may take x and y coordinates from it without any calculation. Such tables appear in the books on map projections by Hammer and Wagner. For reasons of symmetry only the north-east and south-east quadrants need be considered. In the case of the north-east quadrant, reverse the order of the columns as they appear in the table so that the column under 180° appears on the left-hand side. The x coordinates are given directly by the azimuth values; those for the y coordinates are the spherical distances subtracted from 90°. The south-east quadrant values are obtained without reversing the columns, and the x coordinates are given by subtracting the azimuths from 180°. The y coordinates are the spherical distances subtracted from 90° as before, and should be prefixed by the minus sign as they are readings to the south of the x axis. Having produced the basic x and y coordinate values without any calculations, the y's are retained but the x values require modification, and must be multiplied by $\cos^2(y/2)$.

The method of manipulating the oblique spherical tables is well explained by Hammer, in German. The range of tables given in both the books mentioned is identical, and covers latitudes 0°, 15°, 20°, 25°, 30°, 35°, 40°, 45°, 50°, 55°, 60° and 75°. In Wagner's book the values are given in degrees and decimals of a degree, which is unfortunate when trigonometrical functions of the values are required, as in this instance.

This explanation of the use of the valuable tables referred to may lead to a wider appreciation of the variety of purposes to which they can be put, when the production of any map on an oblique system is needed. For purposes of comparison, attention is drawn to the Nordic projection by Bartholomew in the *Citizens' Atlas*. H. J. A.

AN EXPEDITION TO THE SONORA AND MOHAVE DESERTS

A geographical expedition for research into processes of erosion and landscape formation under semi-arid and arid conditions has recently returned to England after several months in Arizona and southern California. The investigation was carried out by Dr. W. G. V. Balchin of King's College in the University of London, and Mr. Norman Pye of Manchester University. Tucson in Arizona was the excellent centre from which the work was organized, and much assistance was given by university colleagues in the departments of Geology, Agriculture and Archaeology at the State University of Arizona.

Particular attention was paid to the evolution of mountain pediments and bahadas. Comparative studies of landscape evolution between the two desert areas were also made; the differences arise because the Mohave is characterized by inland drainage whilst the Sonora has some through-flowing rivers. Transport on the expedition was provided by the ubiquitous Land-Rover, which covered some 6400 miles of territory, much of it roadless, without incident. By careful routing it also proved possible to carry out a general geographical survey of the State of Arizona: here extensive economic development has taken place in the last two decades. Field survey on the expedition was supplemented by colour and monochrome still photography, and a 16-mm. cine-kodachrome record of the country traversed.

The expedition was supported by the Society, and help was also received from the Universities of London and Manchester, the Royal Society and the Fulbright authorities. Photographic and other equipment was provided by various British firms. W. G. V. B.

OBITUARY

PROFESSOR C. B. FAWCETT, B.LITT., D.SC.

The death on September 21 of C. B. Fawcett, emeritus professor of Geography in the University of London, has removed another of the fast-diminishing band of pioneers, who, directly or indirectly influenced by the great Mackinder, carried the new geography to the schools, to the universities and to the wider world of affairs. From school in County Durham Fawcett went as a science student to University College, Nottingham, graduating as an external student in the University of London. A short period of school-teaching was followed by his entry into the Oxford University School of Geography, where

he qualified for the Diploma in Geography and for the B.LITT. degree, and discovered his vocation in the process. It would indeed be difficult to exaggerate the influence at this critical period of his career of Mackinder's brilliantly imaginative treatment of the subject and Herbertson's meticulously thorough methods of training—they gave him an impetus, a direction and a concern for standards in scholarship that were to last him throughout his life. His first university post, as independent lecturer, was at University College, Southampton, where he passed the strenuous years of the First World War, supplementing his single-handed teaching by a virtually full-time responsible post at the Ordnance Survey, a war contribution of no small national value. From Southampton he went to Leeds as head of the new independent Department of Geography, and there, freed at last from London requirements for its external degrees, he faced the responsibility of developing an Honours School *ab initio*, a development that was being paralleled elsewhere in Britain only in London and Liverpool. Nine fruitful years in Leeds were followed by an unsolicited invitation to the Chair of Geography at University College, London, as successor to the brilliant, if somewhat erratic and even sometimes wrong-headed, Professor L. W. Lyde. The transition was eased by a chain of coincidences that resulted in his entering on his new responsibilities at the same time as an almost wholly new staff, whose appointment had been his first duty. That department, reorganized and stamped with the die of his own personality and his philosophy of the subject, remained his own department for twenty-one years and bore effective witness to his capacity as teacher and organizer. On his retirement in 1949 he proceeded to a visiting professorship at Clark University, Mass., which he continued to hold very acceptably until the summer of 1951. His last appointment was as visiting professor and head of the Department of Geography in the University of Ceylon and Colombo, an appointment he was never to complete.

As researcher and writer Fawcett will be remembered chiefly for his studies in two distinct though related fields, political geography and population. His major works were all in political geography: 'Frontiers,' a dispassionate examination of the character and effects of different kinds of political frontier; 'Provinces of England,' a persuasive case for a rational reform of the existing chaos of the politico-administrative units of this country; 'A Political Geography of the British Empire,' a general treatment that gave scope for shrewd assessment of diverse problems and opportunities, but hardly for the close-knit texture of the two earlier books; and finally, published during the recent war, 'The Bases of a World Commonwealth,' which was in effect a summary and application of his whole politico-geographical faith. His population studies on the other hand are to be found as shorter articles scattered through numerous geographical and demographic journals. It is too early yet for any real assessment of Fawcett's place among contemporary leaders of British geographical thought. We are too close to the man himself to be able satisfactorily to separate him from his work and consider his contribution to his subject with a historian's detachment, but some preliminary appreciation may not unjustifiably be attempted. Perhaps his outstanding characteristic was his detestation of guess-work. Whatever his problem, his procedure was by way of a patient and unremitting search for the relevant facts and a cool and deliberate appraisal of the facts so garnered. Abhorring alike the slip-shod and the dramatic, he expounded his methods and his conclusions in simple, direct, lucid English. If he had a weakness, as researcher and teacher, it was that he was so concerned to eliminate emotional elements that he kept his constructive imagination in over-strict subjection: he succeeded in avoiding the errors of

rash generalization to which the visionary is prone, but he possibly missed also some of the heights he might otherwise have reached.

Fawcett's energies were never confined within the framework of his teaching and his research. In each of his three successive university institutions he gave himself unsparingly to the wider administrative responsibilities inseparable from the successful conduct of university affairs. Most exacting of all was his faithful attendance of University boards and committees in London during the Second World War, when he and his staff-depleted department were evacuated to Aberystwyth and the rigours of war-time railway journeys were acute. Worthy of notice, too, was his long and distinguished service to the Association of University Teachers, both in his local branches and in the Central Executive. Outside the strict university milieu he was an active worker in numerous organizations, of which the Geographical Association, the Institute of British Geographers and this Society call for special mention. Of the I.B.G. he was the first president, a fitting recognition not only of his eminence in British geography, but also of the effective help he had given in establishing it. Of the Society he had been a Fellow since 1913, and a Council member and member of the Research Committee for many years.

Tall, spare and physically tough, the man himself had a less immediately impressive impact than, for instance, Mackinder or Roxby. He was quiet, apparently reserved, had none of the arts of the demagogue, but his ability, his sincerity and his innate kindliness always earned the respect and the affection of those with whom he had to do. He is warmly remembered by a host of colleagues and former students, not least by those who in the early days of their acquaintance with him had supposed him to be aloof and impersonal.

R. O. B.

SIR JOHN ROBERT CHANCELLOR, G.C.M.G., G.C.V.O., C.B.E., D.S.O.

Sir John Chancellor, who died on 31 July 1952, at the age of eighty-two, had had a distinguished career as a soldier and colonial administrator. As an officer of the Royal Engineers, he saw service in India and Africa. After holding several colonial governorships, he was appointed the first Governor of Southern Rhodesia from 1923 to 1928, and he was High Commissioner for Palestine from 1928 to 1931. In his later years he maintained his interest in colonial affairs, and served, in several instances as chairman, on numerous public committees, and was a vice-president of the Royal Empire Society and a member of Council of the International Colonial Institute. He was indeed a most distinguished servant of the British Commonwealth.

Sir John became a Fellow of the Royal Geographical Society in 1908, and was for several years a member of Council. From 1935 to 1938 he was a vice-president, and from 1941 to 1948 Foreign Secretary. It was during his term as vice-chairman of the executive committee of the British Council that the Society undertook the production of the Map of Europe and the Middle East for that body. Sir John had always the interests of the Society at heart, and his wide experience made him a valued adviser, particularly as a member of the Finance Committee and in matters coming under his jurisdiction as Foreign Secretary. But those who served the Society with him for many years will remember him most of all for the warmth and kindliness of his conversation, for his cheerful and optimistic outlook in times of stress, for the delight he took in the achievements of others and his modesty concerning his own.

L. B.

MARGARET SWAINSON ANDERSON

By the death of Mrs. Anderson on 15 September 1952, after a long illness, the Cambridge Department of Geography has suffered a great loss. Mrs. Anderson was the second daughter of Dr. J. C. and Mrs. Willis. She had a most distinguished undergraduate career, obtaining first classes in Part I of the Natural Sciences Tripos and in both parts of the Geographical Tripos.

After taking her degree she joined the Manchester department for a few years, and in 1927 came back to Cambridge as a University Demonstrator. She remained in Cambridge until she married, when for some years she lived in Barbados. In the second half of the war Professor Debenham invited her to help in the teaching of cadets, large numbers of whom passed through the Department. Soon after the war a vacancy occurred on the staff, and Mrs. Anderson was elected to a University Lectureship. At about the same time she was re-elected to a Fellowship of Girton College and was naturally Director of Geography students in that College.

Her thorough grounding in the Natural Sciences combined with her wide reading in Geography gave her a unique standing. Up to the time of her death she had lectured mainly in Human Geography and Climatology, but she was evolving an approach to Bio-Geography, in which task she not only had a great interest, but also the essential training. She was proposing to develop this subject in the new Tripos. But in addition Mrs. Anderson possessed abounding energy and an extremely deft pair of hands. Her cartographical standards were second only to her beautiful needlework.

She was a teacher rather than a research worker, and since her own standards were high and her criticisms forceful but kindly she was much sought after as a supervisor. Her publications include 'A Systematic Geography', 'The Geography of Living Things' and another interesting geographical work which is to be published in the spring. She had travelled widely, especially in South America and the West Indies, as well as in Western Europe and Ceylon.

Those of us who knew her will remember her as an able and loyal colleague, as a vivacious and lively companion, and as one who by her own high standards of scholarship and kindness set an example that others would like to follow, but will seldom be able to emulate. J. A. S.

CORRESPONDENCE

THE GEOGRAPHY OF POWER

SIR WILLIAM HALCROW

In his valuable paper on "The Geography of Power" published in the September number of the *Geographical Journal*, Lord Verulam makes a brief reference to Tidal Power, illustrating this by the Mont St. Michel project in Brittany.

Four large tidal power schemes have been investigated in some detail:

1. The Severn scheme.
2. Petitcodiac and Memramcook Estuaries, Bay of Fundy.
3. Passamaquoddy, Maine, U.S.A.
4. Rance scheme, Brittany.

The Severn is by far the largest of these. The Mont St. Michel project which is much larger than any, has it is believed, undergone only a preliminary investigation at present and the Company who are promoting tidal power in France, it is understood, regard the Rance scheme as one for early development and Mont St. Michel for the distant future.

The figures given for Mont St. Michel are 3,000,000 kW. capacity of plant and the output of this would not only be difficult to regulate but if unregulated could only be absorbed by a very large electrical system.

The Severn scheme with a plant capacity of 800,000 kW. and an output of of 2,300 million kWh. per annum would deliver its energy unregulated to the grid and as this output would only be some 6 per cent. of the present load on the grid it could readily be absorbed.

The Severn scheme might I suggest have been added as an appropriate example of tidal power for the Paper. W. HALCROW

1 *October* 1952

THE EGYPTIAN CLIMATE

I shall be grateful for space to comment briefly upon the paper "The Egyptian Climate: An historical Outline" published in your December 1951 issue.

Under the present wind regime northerly winds, frequently strong enough to move dust and sand, prevail throughout the year in the eastern Sahara as far south as about lat. 19° N. South of this southerlies replace the northerlies during the summer (rainy season) for periods increasing with decreasing latitude ('Agriculture in the Sudan,' Oxford University Press, 1948, pp. 64–8), but it is very rare indeed for them to reach as far north as the latitude of Kharga. Records also show no such decrease in the force of the wind south of the line 'Uweinat–Qena as that mentioned, and the region is far from being "an almost windless desert." Some other explanation must be found for the varying nature of the sand formations.

Consideration of the effect of such meteorological factors as wind and rain upon dust and sand movement indicates that under present day conditions there is a net accumulation of aeolian material (principally from the north but also from the south) in about lat. 15° N. That this is the *qoz* region of Kordofan (*op. cit.*, pp. 107–8) suggests that these conditions have prevailed with little change for some considerable time past.

The scanty rainfall records available, and particularly mean annual totals derived from them, may be misleading when considered in a geological context. Evidence is accumulating that the Sahara is far from totally rainless, although the interval between significant falls at a particular place may be large from a biological point of view. Wadi Halfa was long thought to be virtually rainless, so much so that no rain gauge was installed there until 1937. Since that time a little rain has been recorded each year and there were showers yielding more than an inch in 1949 (once) and 1950 (twice). These showers were abnormal by usual standards (unprecedented in the lifetime of the oldest inhabitant, etc.) but may not have been so when considered against a more extensive time-scale. One such shower at a given locality every fifty to a hundred years for thousands of years might be expected to have very significant geological effects (and to contribute materially to the "fossil water" supplies).

Khartoum, A. W. IRELAND
20 *July* 1952

THE ROYAL GEOGRAPHICAL SOCIETY

Kensington Gore, London, S.W.7

FELLOWSHIP AND ASSOCIATE MEMBERSHIP

The object of the Society being the Promotion and Diffusion of Geographical Knowledge, it has always welcomed to its Fellowship those anxious to further this object by their interest and support, as well as those able to take a more active part in the work of discovery and exploration.

It is provided by Chapter III, § 1, of the Bye-Laws that a candidate for admission to the Fellowship of the Society must be proposed and seconded by Fellows. Further, that a candidate is not to be considered eligible until he has attained the age of twenty-one years, unless he holds a Commission in Her Majesty's Forces or is a matriculated student of a University of the United Kingdom or the Self-Governing British Dominions. Proposal forms may be obtained on application to the Director and Secretary, who will also lend if necessary a List of Fellows.

Chapter V, § 1, of the Bye-Laws provides that:—

(a) *Every Fellow (other than those elected under Chapter III, § 6) shall, except as provided below, be required to pay either on Election* [illegible] *as Entrance Fee and Three pounds as Annual Subscription for the current year and thereafter an Annual Subscription of Three pounds due on January 1 in each year; or instead of an Entrance Fee on election an enhanced Annual Subscription of Four pounds for the current and five following years, and thereafter Three pounds; or a single Compounding Fee of Sixty pounds.*

For Fellows who are under the age of 25 years on election the Entrance Fee shall be reduced from Five pounds to Two pounds; or alternatively the enhanced Annual Subscription of Four pounds shall be payable for the current year and for the five following years instead of for five.

Fellows who are on election the wives or husbands of Fellows shall pay no Entrance Fee.

Fellows who are on election the widows or widowers of Fellows shall pay no Entrance Fee if elected within one year of the decease of husband or wife.

(b) *Fellows may compound for their Annual Subscriptions at any subsequent time by a payment of Ten (sixty pounds) less £2 (two pounds) for each Annual Subscription paid in excess of five with a minimum of £10 (twenty pounds) after 25 payments.*

(c) *No Fellow shall be entitled to vote or to enjoy any privilege of the Society while in arrear.*

Chapter IIIa of the Bye-Laws, covering the terms of Associate Membership, provides that:—

1. *Candidates must be not less than 17 and not more than 22 years of age. They must be recommended by a Fellow, University or School authority.*

2. *Subscription shall be £2 per annum without Entrance Fee.*

3. *On attaining the age of 21 Associate Members become eligible for Fellowship. The Entrance Fee of £2 shall be waived provided they have been Associate Members for 3 years. Otherwise Associate Membership shall cease at the age of 21.*

All subscriptions are payable in advance, on the 1st of January in each year.

The privileges of a Fellow or Associate Member include admission (with one Friend) to all ordinary Meetings of the Society, and the use of the Society's House, Library, and Map-room. Each Fellow is also entitled to receive a copy of all the Society's Periodical Publications. Associate Members have the choice of receiving either *The Geographical Journal* or *The Geographical Magazine*. Associate Members may not describe themselves as F.R.G.S. and have no vote at Annual or Special General Meetings.

A pamphlet giving a brief History of the Society, with a description of its Work and Publications, its Charter and Bye-Laws, and an illustrated account of its House in Kensington Gore, can be sent to anyone interested on application to the Director and Secretary.

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